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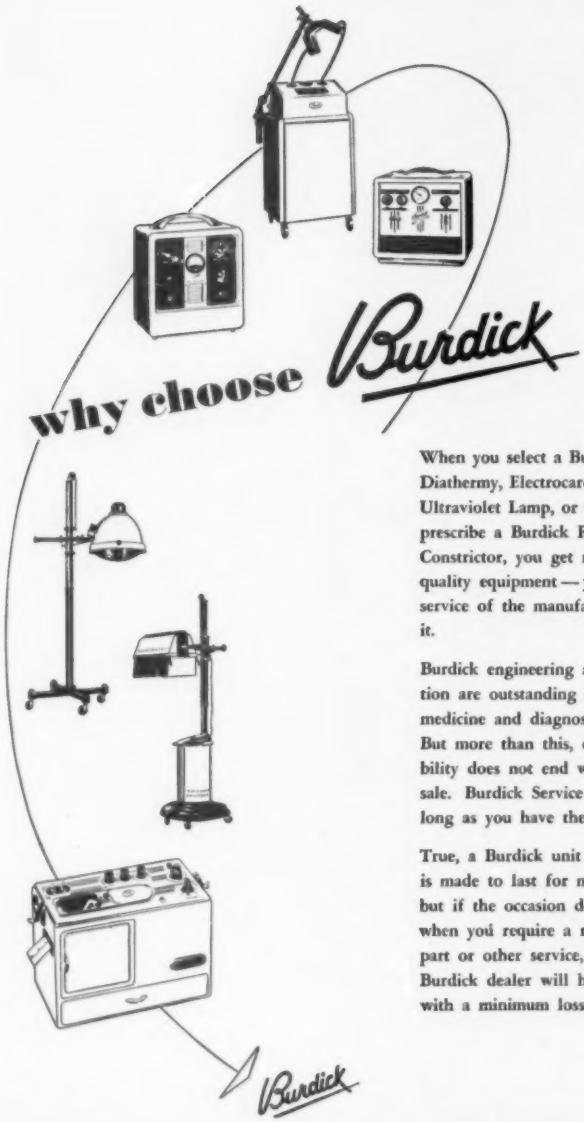

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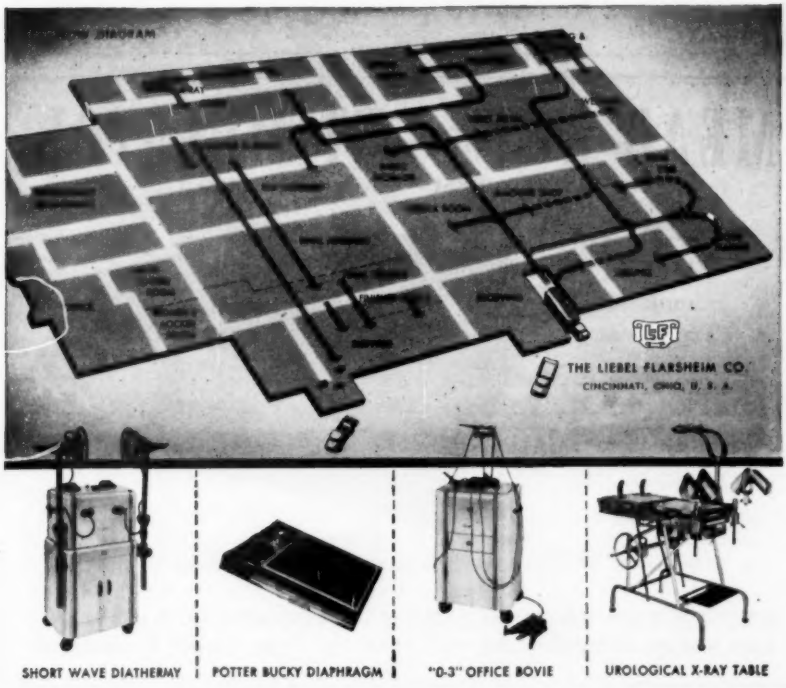

SHORT WAVE DIATHERMY | POTTER BUCKY DIAPHRAGM | "D-3" OFFICE BOVIE | UROLOGICAL X-RAY TABLE

PHYSICAL MEDICINE AND REHABILITATION **

The following services are approved by the Council on Medical Education and Hospitals, and the American Board of Physical Medicine and Rehabilitation. Residencies in this specialty have been approved without specifying the number of years for which they are accredited. The Board will give appropriate credit for training in these hospitals on an individual basis.

Hospitals, 45; Assistant Residencies and Residencies, 87

Name of Hospital	Location	Chief of Service	Inpatients Treated	Number of Treatments	First Year Residencies Offered	Total Residencies Offered	Beginning Stipend (Month)
UNITED STATES ARMY							
Letterman Army Hospital★	San Francisco	R. C. Psaki	4,231	116,264	....	....	.....
Fitzsimons Army Hospital★	Denver	H. B. Luscombe	7,045	230,440	....	....	.....
Army Medical Center★	Washington, D. C.	J. H. Kuitert	5,224	344,228	1	4	.....
VETERANS ADMINISTRATION							
Veterans Admin. Hospital★[1,2]	Long Beach, Calif.	O. L. Huddleston	3,305	182,286	1	1	.....
Veterans Admin. Hospital[1,2]	Denver	C. C. Hoffman	731	11,804	1	3	.....
Veterans Admin. Hospital[1]	Hines, Ill.	L. B. Newman	5,135	463,131	4	4	.....
Veterans Admin. Hospital[1,2]	Wadsworth, Kan.	L. Blau	2,471	174,247	1	2	.....
Veterans Admin. Hospital[1,2]	Framingham, Mass.	F. Friedland	7,100	214,000	1	3	.....
Veterans Admin. Hospital[1,2]	New York City	A. S. Abramson	4,196	302,119	1	3	.....
Veterans Admin. Hospital[1,2]	Cleveland	H. T. Zankel	1,646	78,194	1	1	.....
Veterans Admin. Hospital[1,2]	Portland, Ore.	E. W. Fowlks	4,369	112,456	1	2	.....
Veterans Admin. Hospital[1]	Aspinwall, Pa.	S. Machover	1,957	56,412	1	1	.....
Veterans Admin. Hospital[1]	Memphis, Tenn.	F. I. Mahoney	10,090	162,031	....	....	.....
Veterans Admin. Hospital★[1,2]	Houston, Texas	B. L. Boynton	1,662	60,589	1	2	.....
Veterans Admin. Hospital★[1,2]	Milwaukee	R. Piaskoski	16,084	209,092	....	....	.....
NONFEDERAL							
Los Angeles County Hospital★[1,2]	Los Angeles	E. Austin	.....	93,906	....	1	178
White Memorial Hospital★[1,2]	Los Angeles	F. B. Moor	39,608	39,608	1	1	132
University of Colorado Medical Center Colorado General Hospital★[1,2]	Denver	H. Dinken	2,177	38,381	1	2	150
State of Connecticut Veterans Home and Hospital[1,2]	Rocky Hill, Conn.	N. K. Covalt	663	63,375	....	3	253.34
George Washington University Hospital[1,2]	Washington, D. C.	C. S. Wise	2,433	15,563	....	....	130
Emory University Hospital★[1,2]	Emory Univ., Ga.	R. L. Bennett	1,001	15,846	....	1	250
Georgia Warm Springs Foundation[1,2]	Warm Springs, Ga.	R. L. Bennett	998	114,110	1	4	250
Michael Reese Hospital★[1,2]	Chicago	C. Molander	3,589	30,929	1	1	25
Northwestern University Medical Center[1,2]	Chicago	.....	13,752	43,409	....	....	50
Research and Educational Hospitals★[1,2]	Chicago	F. A. Hellebrandt	12,266	12,266	1	3	60
University of Kansas Medical Center★[1,2]	Kansas City, Kan.	D. Rose	2,563	49,649	....	1	125
Massachusetts General Hospital★[1,2]	Boston	A. L. Watkins	3,039	33,483	....	2	66.67
University Hospital★[1]	Ann Arbor, Mich.	J. W. Rae, Jr.	.....	20,659	2	6	134.16
University of Minnesota Hospitals★[1,2]	Minneapolis	F. J. Kottke	14,007	25,194	2	6	142.50
Mayo Foundation[1,2]	Rochester, Minn.	F. H. Krusen	.....	.....	2	6	150
Barnes Hospital★[2]	St. Louis	S. Mead	9,572	9,572	....	1	25
Bellevue Hospital Center—Division III—New York University College of Medicine★[1,2]	New York City	H. A. Rusk	1,082	83,147	4	7	80
Goldwater Memorial Hospital★[1,2]	New York City	M. Dacso	674	44,446	1	2	90
Hospital for Joint Diseases★[1,2]	New York City	I. Weiss	.....	90,407	1	2	60
Hospital for Special Surgery[2]	New York City	K. G. Hansson	19,388	37,284	1	1	160
Metropolitan Hospital[1,2]	New York City	J. Tobis	1,023	24,788	....	....	.....
Mount Sinai Hospital★[1,2]	New York City	W. Bierman	8,464	32,947	1	1	80
New York City Hospital★[1,2]	New York City	F. K. Safford, Jr.	1,030	37,080	1	1	160
Presbyterian Hospital★[1,2]	New York City	R. C. Darling	5,011	175,061	1	1	208.33
St. Luke's Hospital★[1,2]	New York City	R. Muller	1,099	115,572	1	1	60
Rehabilitation Hospital[1,2]	West Haverstraw, N. Y.	M. Hoberman	517	332,205	1	1	225
Cleveland Clinic Hospital[1,2]	Cleveland	W. J. Zeiter	16,638	36,957	1	3	150
University Hospitals Ohio State University Hospital[1,2]	Columbus, Ohio	R. E. Worden	1,245	18,894	....	....	125
Hospital of the Univ. of Pennsylvania★[1,2]	Philadelphia	G. Piersol	2,771	45,549	....	1	.....
Philadelphia General Hospital★[1,2]	Philadelphia	A. Martucci	1,225	66,802	2	2	112

The Star (★) indicates hospital approved for intern training.
1 Residencies open to women.
2 Available to graduates of foreign medical schools.
3 Includes fellowships.

** Reprinted in part J. A. M. A. **150**:339 (Sept. 27) 1952.

APPROVED SCHOOLS OF OCCUPATIONAL THERAPY **

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Director and Medical Director	Entrance Requirements	Duration of Course[1]	Classes Begin	Graduates in 1950	Tuition per Year	Certificate, Diploma, Degree
University of Southern California, Los Angeles*	Margaret S. Rood	Degree	18 mos.	Varies	12	$594	Certificate
	I. B. Armstrong, M.D.	High sch.	5 yrs.	Varies	19	$540	Cert. & Deg.
Mills College, Oakland, Calif.	Elsa H. Hill	Degree	2½ yrs.	FebSept	2	$250	Certificate
	S. M. Dorinson, M.D.	High sch.	5 yrs.	FebSept	4	$650	Cert. & Deg.
San Jose State College, San Jose, Calif.*	Mary D. Booth	Degree	18 mos.	Varies	1	$ 28.50	Certificate
	Charles Ianne, M.D.	High sch.	45 mos.	Varies	13	$ 28.50	Cert. & Deg.
University of Illinois College of Medicine, Chicago*	Beatrice D. Wade	High sch.	5 yrs.	MarSept	13	$110	Degree
	S. W. Olson, M.D.						
State University of Iowa, Iowa City*	Marguerite McDonald		19 mos.	FebSept	2	$144[2]	Certificate
	W. D. Paul, M.D.	High sch.	46 mos.	FebSept	5	$144[2]	Cert. & Deg.
University of Kansas, Lawrence	Nancie B. Greenman	High sch.	45 mos.	FebSept	16	$135[2]	Degree
	D. L. Rose, M.D.						
Boston School of Occupational Therapy, 7 Harcourt St., Boston*	Marjorie B. Greene	Degree	2 yrs.	Sept	13	$500	Diploma
	A. W. Reggio, M.D.	High sch.	5 yrs.	Sept	21	$500	Degree
Wayne University, Detroit*	Barbara Jewett	Degree	19 mos.	Varies	1	$150	Certificate
	F. A. Weiser, M.D.	High sch.	46 mos.	Varies	2	$150	Degree
Kalamazoo School of Occupational Therapy, Kalamazoo, Mich.*	Marion R. Spear	Degree	18 mos.	FebSept	3	$ 75[2]	Diploma
	R. B. Burrell, M.D.	1 yr. coll.	4 yrs.	FebSept	23	$ 75[2]	Dipl. & Deg.
Michigan State Normal College, Ypsilanti, Mich.*	Frances Herrick	High sch.	5 yrs.	FebSept	6	$ 67.50[2]	Cert. & Deg.
	V. L. VanDuzen, M.D.						
University of Minnesota, Minneapolis*	Borghild Hansen	High sch.	40 mos.	Sept	12	$126[2]	Degree
	F. J. Kottke, M.D.						
College of St. Catherine, 2004 Randolph, St. Paul	Sister Jeanne Marie	High sch.	4½ yrs.	Varies	24	$225	Degree
	J. M. Ryan, M.D.						
Washington University School of Medicine, St. Louis*	Erna L. Rozmarynowski	Degree	11-14 mos.	Sept	—	University	Certificate
	R. A. Moore, M.D.	2 yrs. coll.	28 mos.	Sept	14	University	Degree
University of New Hampshire, Durham*	Esther Drew	High sch.	5 yrs.	Sept	8	$200[2]	Cert. & Deg.
	I. A. MacDonald						
Columbia University College of Physicians and Surgeons, New York City*	Marjorie Fish	Degree	17 mos.	Sept	20	$600	Certificate
	W. B. Snow, M.D.	2 yrs. coll.	27 mos.	Sept	10	$600	Degree
New York University School of Education, New York City*	Frieda J. Behlen	1 yr. coll.		FebSept	3	$500	Certificate
	John Sawhill, M.D.	High sch.	4½ yrs.	FebSept	26	$500	Cert. & Deg.
Ohio State University, Columbus*	Martha E. Jackson	High sch.	4 yrs.	Varies	15	$ 90[2]	Degree
	R. H. Jacques, M.D.						
Philadelphia School of Occupational Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia*	Helen S. Willard	Degree	18 mos.	Sept	21	$600	Certificate
	J. C. Yaskin, M.D.	High sch.	5 yrs.	Sept	1	$600	Degree
Texas State College for Women, Denton	Fanny B. Vanderkooi	Degree	18 mos.	FebSept	—		Certificate
	O. T. Woods, M.D.	High sch.	5 yrs.	FebSept	5	$ 50	Degree
Richmond Professional Institute, 901 W. Franklin St., Richmond, Va.*	H. Elizabeth Messick	High sch.	4 yrs.	Sept	5	$200	Degree
	I. E. Barrett, M.D.	Degree	10-18 mos.	FebSept	4	$182+	Certificate
College of Puget Sound, 18th and Warner Sts., Tacoma, Wash.*	Edna-Ellen Bell		2 yrs.	FebSept	—	$400	Certificate
	A. J. Hermann, M.D.	High sch.	5 yrs.	FebSept	5	$350	Cert. & Deg.
University of Wisconsin, Madison*	Caroline G. Thompson	High sch.	5 yrs.	Sept	12	$120[2]	Cert. & Deg.
	H. D. Bouman, M.D.						
Milwaukee-Downer College, Dept. of Occupational Therapy, 2512 E. Hartford Ave., Milwaukee	Henrietta W. McNary	2 yrs. coll.	3 yrs.	Sept	2	$350	Diploma
	M. C. Borman, M.D.	High sch.	5 yrs.	Sept	20	$350	Dipl. & Deg.
Mount Mary College, 92d and Burleigh, Milwaukee	Sister Mary Arthur	High sch.	5 yrs.	Sept	14	$260	Cert. & Deg.
	J. C. Griffith, M.D.				—		

** Reprinted J. A. M. A. 146:108 (May 12) 1951.

1. Duration of course is expressed in academic years or in number of months.

2. Nonresidents charged additional fee.

* Male as well as female students admitted.

APPROVED SCHOOLS OF PHYSICAL THERAPY **

Council on Medical Education and Hospitals of the American Medical Association

Name and Location of School	Medical Director and Technical Director	Entrance Requirements [1]	Duration of Course	Classes Begin	Maximum Enrolment	Tuition	Certificate, Diploma, Degree
Medical Department — U. S. Army							
(Address all inquiries to the Office of the Surgeon General, Department of the Army, Washington 25, D. C.)							
Medical Field Service School, Brooke Army Medical Center, San Antonio, Texas	Charles D. Shields, Lt. Col., M.C. Agnes P. Snyder, Major, WMSC	e	49 wks.	Mar.-Sept.	26	None	Certificate
Fitzsimons Army Hospital, Denver	H. B. Luscombe, Col., M.C. Olena M. Cole, Maj., WMSC	Affiliated with Medical Field Service School					
Letterman Army Hospital, San Francisco, California	Raoul C. Psaki, Lt. Col., M.C. Emma Harr, Maj., WMSC	Affiliated with Medical Field Service School					
Walter Reed Army Hospital, Washington, D. C.	J. H. Kuitert, Lt. Col., M.C. Brunetta Kuehlthau, Maj., WMSC	Affiliated with Medical Field Service School					
Nonfederal							
Childrens Hospital, Los Angeles*	S. S. Matthews, M.D. Mrs. Mary J. Dodge	a-b-d	14 mos.	Sept	14	$300	Cert. or Degree
College of Medical Evangelists, Los Angeles*	F. B. Moor, M.D. R. Wm. Berdan	a-b-c	15 mos.	Sept	16	$300	Cert. or Degree
University of Southern California, Los Angeles*	C. L. Lowman, M.D.	a-b-d	14 mos.	Sept	16	Univer.	Certificate
	Charlotte W. Anderson	f	4 yrs.	FebSept	6	Univer.	Cert. & Degree
University of California School of Medicine, San Francisco*	Lucile Eising, M.D. Margery L. Wagner	d	12 mos.	Sept	16	$220[3]	Cert. or Degree
Stanford University, Stanford University, Calif.*	W. H. Northway, M.D.	a-d-e	12 mos.	Varies	29	$690	Certificate
	Lucille Daniels	f	4 yrs.	Sept	16	$220 qr.	Degree
University of Colorado Medical Center, Denver*	Harold Dinken, M.D. Dorothy Hoag	a-b-d	12 mos.	Sept	12	$208[3]	Cert. or Degree
Northwestern University Medical School, Chicago	E. D. W. Hauser, M.D. Elizabeth C. Wood	a-b-d	12 mos.	Oct	16	$450	Certificate
State University of Iowa College of Medicine, Iowa City*	W. D. Paul, M.D. Olive C. Farr	e	12 mos.	Sept	20	$200	Certificate
University of Kansas Medical Center, Kansas City, Kan.*	D. L. Rose, M.D.	d	12 mos.	FebSept	3	$40[3]	Certificate
	Ruth G. Monteith	f	4 yrs.	FebSept	9	$40[3]	Degree
Simmons College, Boston	W. T. Green, M.D.	a-e	16 mos.	Sept	24	College	Diploma
	Shirley M. Cogland	f	4½ yrs.	Sept		College	Degree
Boston University College of Physical Education for Women, Sargent College, Cambridge, Mass.	Kenneth Christophe, M.D. Adelaide L. McGarrett	c-d-e-f	1-2-4 yrs.	Sept	30	Univer.	Cert. or Degree
Bouve-Boston School in affiliation with Tufts College, Medford, Mass.	Howard Moore, M.D. Constance K. Greene	f	4 yrs.	Sept	16	$550	Dipl. & Degree
University of Minnesota, Minneapolis*	F. J. Kottke, M.D. Ruby Green Overmann	c	2 yrs.	Sept	30	$126	Degree
Mayo Clinic, Rochester, Minn.*	E. C. Elkins, M.D. Harry Keown	a-b-c	2 yrs.	Sept	38	$250	Certificate
St. Louis University, Division of Health and Hospital Services, St. Louis*	A. J. Kotkis, M.D. Sister Mary Imelda	f	4 yrs.	JanSept	12	$175 Semes.	Degree
Washington University School of Medicine, St. Louis*	Sedgwick Mead, M.D. Beatrice F. Schulz	c	2 yrs.	Sept	16	$450 1st yr.[3] $325 2d yr.[3]	Degree
Albany Hospital, Albany, N. Y.	J. W. Ghormley, M.D. Catharine Graham	a-b-d f	12 mos. 4 yrs.	Sept Sept	6	$300 $500	Certificate Degree
Columbia University College of Physicians and Surgeons, New York City*	W. B. Snow, M.D. Mary E. Callahan	a-c-e	1-2 yrs.	Sept	50	$680 (1 yr.) $1,200 (2 yrs.)	Cert. or Degree
New York University School of Education, New York City*	G. G. Deaver, M.D. Elizabeth C. Addoms	a (+1 yr. coll.) b-d	12 mos.	Sept	40	$760	Cert. & Degree
Duke University, Durham, N. C.*	L. D. Baker, M.D. Helen Kaiser	a-b-d	15 mos.	Oct	12	$350	Certificate
Cleveland Clinic Hospital, Cleveland*	Walter J. Zeiter, M.D. Dorothy Spark	a-b-c	12 mos.	Oct	12	$200	Diploma
D. T. Watson School of Physical Therapy, Leetsdale, Pa.*	Jessie Wright, M.D. Kathryn Kelley	a-b-d	12 mos.	Oct	25	$300	Diploma
Divimon of Physical Therapy of the School of Auxiliary Medical Services of the University of Pennsylvania, Philadelphia*	G. M. Piersol, M.D. Dorothy E. Baethke	e f	12 mos. 4 yrs.	FebSept Sept	32 40	$600 $600	Certificate Cert. & Degree
University of Texas School of Medicine, Galveston*	G. W. N. Eggers, M.D. Ruby Decker	a-b-d	12 mos.	Jan	8	$149[3]	Cert. or Degree
Hermann Hospital, Houston, Texas*	O. O. Selke, Jr., M.D. Elizabeth Barkley	a-b-d	12 mos.	Oct	15	$300	Certificate
Baruch Center of Physical Medicine and Rehabilitation, Medical College of Virginia, Richmond*	Herbert Park, M.D.	a-b-d	12 mos.	Sept	62	$300[3]	Diploma
	Susanne Hirt	f	4 yrs.	Sept			Degree
University of Wisconsin Medical School, Madison*	H. D. Bouman, M.D. Margaret A. Kohli	a-b-d f	12 mos. 4 yrs.	Sept FebSept	22 20	$60 Semes.[3]	Certificate Cert. & Degree

** Reprinted in part J. A. M. A. 146:197 (May 12) 1951.

1. Courses are so arranged that any of the entrance requirements will qualify students for training. a — Graduation from accredited school of nursing; b — Graduation from accredited school of physical education; c — Two years of college with science courses; d — Three years of college with science courses; e — Four years of college with science courses; f — High school graduation.

2. Nonresidents charged additional fee.

* Male as well as female students admitted.

3. Effective July 1, 1952, tuition will be $282.50 for each of the first three semesters, and $113.50 for the fourth semester, making a total of $900.00 for two years.

SUGGESTIONS FOR CONTRIBUTORS

While the ARCHIVES OF PHYSICAL MEDICINE is published by The American Congress of Physical Medicine, contributions of interest to those in the field of physical medicine are welcome from all countries of the world.

Manuscripts offered for publication in the ARCHIVES OF PHYSICAL MEDICINE should be sent to the Editorial Office, ARCHIVES OF PHYSICAL MEDICINE, 30 N. Michigan Ave., Chicago 2, Illinois.

Articles are accepted only with the understanding that they are contributions exclusively to the ARCHIVES OF PHYSICAL MEDICINE. Articles and their illustrations become the property of the journal.

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REFERENCES Have references numbered consecutively throughout the paper, and check to make sure that there is an insertion number in the text for each reference. References not referred to in the text will not be published. These references should be typed on separate pages at the end of the manuscript, since they are not on the same linotype machine as the rest of the article. The style should follow that of the **Journal of the American Medical Association** and/or the **Quarterly Cumulative Index Medicus.** The reference must include the name and initials of each author, and the volume number, page number and complete date of publication. If you do not know the standard abbreviations for the names of the journals, give the name in full. Home-made abbreviations are NOT acceptable and cannot be published. Please bear in mind that **The Lancet** and the **Journal-Lancet** are different publications. Inaccuracy in citing references may make it necessary to delete important footnotes.

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ARCHIVES OF PHYSICAL MEDICINE
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ORIGINAL ARTICLES

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EDITOR OF THE MONTH

GEORGE MORRIS PIERSOL, M.D.

Philadelphia, Pa.

Printed in U.S.A.

RESOLUTION APPROVED

The report of the Council on Medical Education and Hospitals of the American Medical Association was approved by the Advisory Board of Medical Specialties at its business meeting on February 10, 1952. Included in this report was the following Resolution:

"Whereas, An emergency medical call service is of proven value both as a community public service and as a means of good public relations between a physician and his community; and

'Whereas, Participation in such a service is not onerous if many physicians cooperate; and

"Whereas, Every County Medical Society has been asked to operate such an emergency service; therefore be it

"Resolved, That every doctor below the age of 35 years, regardless of his type of practice, be urged to participate in his community's call plans; and be it further

"Resolved, That all national specialty boards be requested by the Secretary of the American Medical Association to facilitate such general participation by assuring their members and potential members that they may participate in such a community activity without jeopardy to specialty ratings.

"Amendment —

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CHICAGO SOCIETY OF PHYSICAL MEDICINE AND REHABILITATION

Wednesday, December 3, 1952

Dinner, 6 . . M., Pizzeria Napolitana, 907 Taylor Street, Chicago.

Scientific Session, 8 P. M., Room 106, University of Illinois Research and Educational Hospitals, 1819 W. Polk St.

Subject: "Physiological Devices for the Facilitation of Work Output in the Rehabilitation of the Disabled." Dr. Frances Hellebrandt.

Make reservations with the Secretary, Dr. Milton G. Schmitt, 6970 N. Clark St., Chicago 26.

The Second John Stanley Coulter Memorial Lecture

REPORT ON THE INTERNATIONAL CONGRESS OF PHYSICAL MEDICINE *

FRANK H. KRUSEN, M.D.

Section of Physical Medicine and Rehabilitation

Mayo Clinic, Rochester, Minnesota

It is a signal honor to have the privilege of rendering homage to the memory of a distinguished pioneer and inspiring leader in physical medicine and rehabilitation, John Stanley Coulter. It was my good fortune to work very closely with John Coulter for many years prior to his untimely death. His complete lack of affectation, his zeal for the advancement of our discipline, his ready good humor and his genius for leadership and diplomacy endeared him to all of us.

Supreme among his interests was his constant concern for the forward progress of our branch of medical practice. I have a vivid memory of his exultation whenever the specialty made another step forward. I recall, as if it were yesterday, how he beamed with delight when we were informed that the establishment of an American specialty board in physical medicine and rehabilitation had been approved. I know, therefore, how very greatly he would have been gratified to hear this report of still another tremendous stride forward, this time on an international scale.

On July 13, 1952, at King's College, London, England, representatives of associations of physical medicine from fifteen nations convened and formally constituted the International Federation of Physical Medicine (with membership in the Council for Co-ordination of International Congresses of Medical Sciences). The national associations of physical medicine which became founder members and the chairmen of their delegations were as follows: Argentina, Dr. O. Rosenberg; Australia, Dr. B. G. Wade; Austria, Dr. V. E. Klare; Belgium, Prof. J. Michez; Canada, Dr. G. Gingras; Denmark, Dr. S. Clemmesen; Germany, Prof. R. Schulze; Great Britain, Dr. W. S. Tegner; Holland, Dr. D. J. van Bosveld Heinsius; Israel, Dr. E. Adler; Norway, Dr. O. Mellbye; Spain, Dr. J. M. Poal; Sweden, Dr. A. Gjertz; Switzerland, Dr. V. R. Ott, and United States of America, Dr. W. J. Zeiter. Furthermore, during the meeting, the national associations of physical medicine of the following countries were accepted provisionally for membership in the Federation: France and Yugoslavia.

Observers from the following countries, which have no associations of physical medicine, also attended the meeting of the International Federation: Cuba, Dr. J. I. Tarafa; Egypt, Dr. Salama-Bey; Eire, Dr. Mary O'Donnell; Italy, Dr. Villani, and Portugal, Dr. F. Formigal Luzes.

Likewise representatives from two other countries, who were unable to attend, expressed a desire to support and participate in the future activities of the Federation. These were: Brazil, Dr. Waldemar Bianchi, and Chile, Dr. Ernesto Saldias. Thus the associations of fifteen nations became founder members of the Federation, the associations from two other nations were given provisional membership, and seven additional nations sent observers or expressed a desire to support the Federation.

* Presented at the meeting of the American Congress of Physical Medicine, New York, New York, August 27, 1952.

Dr. Frank Krusen (United States of America) was elected first president of the Federation, Dr. Philippe Bauwens (Great Britain) was elected the first honorary secretary, and Dr. Hugh Burt (Great Britain) was elected the first honorary treasurer. Subsequently Dr. A. T. Richardson (Great Britain) was appointed assistant secretary. The permanent offices of the Federation were established in London with the understanding that the location of these offices would be reconsidered at the time of the next congress. It was agreed that full membership in the congresses of the Federation should be restricted to qualified physicians and surgeons. An executive committee to conduct the business of the Federation between congresses was elected. This committee consists of the following members: Lord Horder (Great Britain), president of the Federation; Dr. Frank Krusen (United States of America), past president of the Federation; the president of the forthcoming congress (Denmark); the honorary secretary of the forthcoming congress (Denmark); Dr. A. C. Boyle (Great Britain), honorary secretary of the preceding congress; the honorary treasurer of the forthcoming congress (Denmark); Dr. Philippe Bauwens (Great Britain), honorary secretary of the Federation; Dr. Hugh Burt (Great Britain), honorary treasurer of the Federation; Dr. O. Rosenberg (Argentina); Prof. J. Michez (Belgium); Dr. Svend Clemmesen (Denmark); Dr. V. R. Ott (Switzerland), and Dr. W. J. Zeiter (United States of America).

It was voted unanimously that each member association should be asked to pay an annual subscription to the Federation of 2 shillings sterling (approximately 28 cents) per individual member of their association. It was agreed that hereafter the Federation should have three official languages: French, English and Spanish. The following properties and insignia were received by the Federation: ceremonial lamp (presented by Lord Horder), gavel and block (presented by Mrs. Richard Kovács, and presidential badge (presented by Mr. Bernard Baruch). It was agreed that the next International Congress of Physical Medicine should be held in Denmark in 1956.

Following this important organizational meeting, there was a reception given by the ladies committee of the congress in the Council Room of King's College. All members and social associate members were invited to attend this delightful reception. On Sunday evening, July 13, Dr. and Mrs. Francis Bach of London gave at their home an enjoyable buffet supper and reception for the delegates to the Federation and their wives. All of the guests seemed greatly to appreciate the hospitality of our host and hostess.

On Monday, July 14, the impressive opening ceremony was held at 11 a. m. in the Great Hall of King's College (fig. 1). The speakers and guests of honor were robed in academic costumes and following the colorful procession, Marshal of the Royal Air Force, the Lord Tedder, G.C.B., gave the opening oration and lit the ceremonial lamp presented previously by Lord Horder. Then as president of the Federation, it was my privilege to install Lord Horder as president of the congress for 1952 and to invest him with the presidential badge, presented previously by Mr. Bernard Baruch. Lord Horder then assumed the chair and called the congress to order with the gavel and block presented previously by Mrs. Richard Kovács. Speeches of welcome were given on behalf of Her Majesty's Government by the Right Honorable Iain N. Macleod, minister of health and, on behalf of the International Federation of Physical Medicine, by Dr. Frank Krusen, president of the Federation. Replies were tendered by Dr. Svend Clemmesen of Denmark and by Dr. Max Walthard of Switzerland. Then the Right Honorable Lord Horder, G.C.V.O., gave his excellent presidential address and the ceremonies

were closed with a vote of thanks to Lord Tedder by Dr. Frank Howitt of Great Britain.

Fig. 1. — Opening ceremonies of the International Congress of Physical Medicine. The Great Hall, King's College, England, July 14, 1952.

The superb timing and beautiful pageantry of this opening ceremony inaugurated the meetings of the congress in most auspicious fashion. Following the recession, there was a reception in the robing room at King's College which was tendered by the American delegation to the speakers and guests of honor.

In the afternoon at 2:30 p. m., in my capacity as president of the Federation, I accompanied the president of the congress, Lord Horder, during the opening of the exhibitions. On an upper floor of King's College, there were an excellent scientific and historical exhibition and also a well-organized trade exhibition arranged under the able direction of Dr. Clive Shields. The American scientific exhibitors included A. A. Rodriquez, D. A. Schram, H. A. Rusk, and J. E. Markee. Of particular interest among the British exhibits were a kitchen unit designed for the disabled housewife and presented by Frank Cooksey, a display of electronic equipment presented by Philippe Bauwens, and an exhibit on the history of physical medicine presented by the Wellcome Historical Medical Museum of Great Britain. The trade exhibition included the display of equipment from Great Britain, Austria and Germany. Electrodiagnostic devices, variable-frequency apparatus, ultrasonic-therapy equipment, short-wave-diathermy machines, microwave-diathermy apparatus and textbooks on physical medicine were included in this display. It was gratifying to find so much new and well-constructed European equipment available.

At 3 p. m. on Monday there was presented in the Great Hall at King's College a symposium on "Developments in Physical Medicine in the Past Decade." F. D. Howitt described the development in Great Britain, F. H. Krusen outlined the progress in the United States of America, S. Clemmesen detailed the advances in Denmark, and V. E. Klare reported on the struggles

for progress in Austria. It was the consensus of these physicians that World War II has stimulated the development of physical medicine. Our discipline has progressed from a therapeutic to a clinical specialty. Thorough diagnosis and rational prescription of treatment are essential. Physical medicine has progressed from empiricism to precision in diagnosis and treatment. There has been a remarkable increase in laboratory and clinical research in this field. There is a growing program of teaching of physical medicine in the universities. The value of rehabilitation programs in various hospitals is being increasingly recognized. Contacts between various nations concerning advances in physical medicine are developing rapidly. A vigorous new medical specialty, which emphasizes research and the clinical aspects of practice, has come into being during the past decade. The international picture which these four speakers presented was a most encouraging one.

During this same afternoon, the social associate members were provided with a tour of the Zoological Gardens in Regents Park. Following the scientific session, the official photograph of the congress was made. Then from 6 to 8 p. m., Her Majesty's Government held a reception for the members and associate members of the congress at Lancaster House, St. James. The Right Honorable Iain Macleod, minister of health, received the guests. The reception in this magnificent official residence was a most enjoyable occasion. Still, for many of us, this amazingly well-organized and fascinatingly interesting first day of the congress was not complete. The president and council of the Royal College of Surgeons of England tendered a dinner to all the

Fig. 2. — Dinner tendered to the delegates to the International Federation of Physical Medicine by the President and Council of the Royal College of Surgeons, Lincoln's Inn Fields, London, England, July 14, 1952.

national representatives of the International Federation at the Royal College of Surgeons, Lincoln's Inn Fields (fig. 2).

Our host, Sir Cecil Wakeley, president of the college, greeted us and finally, preceded by his mace bearer, led us to the dining hall. Following this delightful and friendly dinner, there was a toast to Her Majesty the

Queen and the members of the royal family. Sir Cecil then proposed a toast to the International Federation to which I responded as president of the Federation. Then Sir James Paterson Ross, senior vice-president of the Royal College of Surgeons, proposed a toast to the International Congress of Physical Medicine and replies were given by Lord Horder and by Dr. Svend Clemmesen of Denmark. All of our delegates were deeply appreciative of the hospitality shown by our hosts, and following the dinner, they enjoyed particularly a visit to the museum of the college where they viewed the interesting relics of the investigations of John Hunter and of the early surgical activities of Lord Lister. Of especial interest to many of the guests was a recent acquisition, the collection of "Belsen hearts." These were hearts of people who had died of starvation in Belsen prison camp. Amazingly they were approximately only one-fifth the size of normal hearts! We were profoundly shocked by this tragic evidence of extreme starvation and of man's inhumanity to man.

On Tuesday morning, July 15, E. Grandjean (Switzerland), and W. Tegnar (Great Britain) presented valuable discussions on physical education and then the members of the congress traveled by bus to Aldershot where we lunched. In the afternoon our group observed interesting demonstrations by Mr. A. H. Gem, of physical education and conditioning of London school children, and exhibitions of conditioning and remedial exercise programs for groups of Army recruits, presented by Brigadier R. H. L. Oulton and Lt. Col. J. B. M. Milne, as well as demonstrations of standard tests and battle physical training. While our members were visiting Aldershot, the social associate members were making an equally interesting visit to Windsor and Windsor Castle. On Tuesday evening the members and social associate members of the congress were entertained by the Worshipful Society of Apothecaries of London at a reception in the Ancient Apothecaries Hall, which was built in the tenth century and was once occupied by the Black Friars. Our host and hostess on this occasion were Dr. and Mrs. Frank Howitt. Dr. Howitt is vice-chancellor of the time-honored Apothecaries Guild, and all the guests enjoyed seeing this tradition-laden building with its many fine old pictures including one attributed to Valesquez and another to Holbein.

On Wednesday morning, July 16, H. A. Rusk (United States of America), P. Houssa (Belgium) and F. S. Cooksey (Great Britain) participated in a symposium on rehabilitation and resettlement in the Great Hall at King's College. This symposium was followed by a forum under the chairmanship of H. Balme (Great Britain). The speakers of the morning participated as did also R. L. Bennett (United States of America), C. J. S. O'Malley (Great Britain), and W. J. Zeiter (United States of America). It was the consensus of the speakers at this symposium and forum that rehabilitation has become established as a new medical discipline which aims at restoration of the physically handicapped person to normal life; that physicians should avoid an attitude of hopelessness or passive acceptance in the face of chronic illness or disability; that a dynamic approach to chronic illness frequently results in restoration of the chronically ill patient to a fair measure of self-sufficiency, self-respect and happiness; that physicians should be interested not only in adding years to life but also in adding life to years; and further that in the approach to the management of disabling conditions, the physician should always consider the psychologic as well as the physical problems. It was brought out that rehabilitation aims at returning the handicapped individual to a normal living and working environment or to the most suitable alternate conditions possible; it is inextricably conjoined with physical medicine and

may be defined as the preparation of the patient physically, mentally, socially and vocationally for the fullest possible life compatible with his abilities and disabilities.

In the afternoon there were two important sessions: one was a symposium on various aspects of rehabilitation and the other was a symposium on the management of poliomyelitis, followed by papers on treatment of cerebral palsy and geriatric rehabilitation. In the symposium on rehabilitation, eight papers provided extensive coverage of many aspects of the subject. Henry Kessler (United States of America) mentioned that many minds and skills meet on the rehabilitation team which under the leadership of the medical director consists of physicians, nurses, therapists and counsellors. T. M. Ling (Great Britain) pointed out that the psychologic aspects of rehabilitation should be understood not only by physicians but also by governmental agencies, employers and the public. A. B. C. Knudson (United States of America) indicated that the accomplishment of rehabilitation objectives produced tremendous economic savings. The other speakers in this symposium included V. A. Porsman (Denmark), G. H. Fisk (Canada), A. J. Martin, and R. Harris (Great Britain), G. Gingras (Canada), and C. B. W. Parry (Great Britain). They were in general agreement with the previous speakers of the day concerning the importance of modern rehabilitation procedures.

In the other session of the afternoon there were also eight papers. R. L. Bennett (United States of America) discussed the use of splints, corsets, supports, braces and crutches as an essential phase of convalescent care of poliomyelitis. H. E. Weiser (Israel) advocated the intensive use of progressive power exercises for young children having poliomyelitis. M. E. Knapp (United States of America) presented a follow-up study on 391 patients who had poliomyelitis. Also included were papers by Kottke, Kubicek and Olson (United States of America) on vasomotor activity in the feet following poliomyelitis; by F. F. Luzes (Portugal) on physical treatment of poliomyelitis; by Mary O'Donnell (Eire) on treatment of cerebral palsy; by L. Cosin (Great Britain) on geriatric rehabilitation; and by E. F. Wadge (Great Britain) on geriatric rehabilitation. Also during this afternoon a variety of scientific motion pictures dealing with various phases of physical medicine and rehabilitation from Canada, Cuba, Great Britain and the United States were shown. Meanwhile during this busy day, the social associate members had attended a style show in the morning and paid a visit to Hatfield House in the afternoon.

On Wednesday evening, there were two receptions: one by the Ciba Foundation and another tendered jointly by the Empire Rheumatism Council and the Heberden Society. Both were particularly pleasant occasions and the members were shown once more how exceedingly warm and cordial British hospitality can be.

On Thursday morning, July 17, the scientific session consisted of a morning symposium on "The Management of Chronic Rheumatism and Other Disorders of the Locomotor System" followed by a forum on this subject. F. D. Hart (Great Britain) expressed the belief that rehabilitation of chronic rheumatic disorders could be achieved more readily with proper use of corticotropin, cortisone and hydrocortisone. He warned, however, of potential dangers when these agents were administered, and advocated their use only in selected cases under careful supervision. L. J. Michotte (Belgium) discussed "low backache" and concluded that it was commonly the result of irritation of the spinal ganglions of the first, second and third lumbar nerves. H. A. Burt and his associates (Great Britain) discussed the painful shoulder

and concluded that physical therapeutic measures are definitely indicated in its management. During the succeeding forum under the chairmanship of F. D. Howitt (Great Britain), the speakers of the morning were joined by W. S. Tegner (Great Britain) and K. M. Walthard (Switzerland). A lively discussion ensued which indicated definitely the continuing importance of physical medicine and rehabilitation in chronic rheumatic disorders.

During the afternoon a series of papers on the topic of the morning was presented. J. Michez (Belgium) discussed the physical treatment of rheumatoid arthritis and emphasized its importance. He stated that a complete department of physical medicine must exist in every center for rheumatic diseases. E. W. Lowman (United States of America) discussed rehabilitation of the chronic rheumatoid arthritic derelict. He recommended that during prolonged cortisone therapy the dose be kept below 75 mg. per day. He added that while increase of muscular power and range of motion of joints is important, the real objective of rehabilitation is functional training toward proficiency in activities necessary for self-sufficient living. H. Petty (Great-Britain) discussed the orthopedic aspects of rheumatoid arthritis, and F. Bach (Great Britain) concluded that by using cortisone wisely the specialist in physical medicine can often treat rheumatoid arthritis with less discomfort and achieve his aim more quickly with fewer setbacks. The other papers of the afternoon included discussions of treatment of osteoarthritis of the hip by W. A. Fell (Great Britain), of a device for cervical traction by J. M. Poal and J. F. Condominas (Spain), of studies on permeability of synovial membrane by W. D. Paul and J. I. Routh (United States of America), and of after-care of acrylic-head arthroplasties of the hip by O. Troisier (France).

Also on Thursday afternoon, in another lecture hall, a series of general papers on various aspects of physical medicine was presented. R. Harris and his associates (Great Britain) reported on a study of circulatory changes in skin and muscle during reflex heating. It was emphasized that changes in temperature of the skin provide no indication of the circulation in underlying muscles. J. H. Aldes (United States of America) discussed ultrasonic treatment of osteoarthritis of the cervical and lumbosacral regions of the spinal column. V. R. Ott (Switzerland) concluded that certain systemic heat treatments produce activation of the pituitary-adrenal system while others produce a cholinergic (parasympathetic) effect. R. Schulze (Germany) discussed secondary pigmentation following ultraviolet irradiation. M. Fuchs (Switzerland) described the "syncardial method" of treating peripheral vascular diseases, A. Stoddard (Great Britain) discussed the short-leg and low back syndrome, and L. J. Michotte (Belgium) advised resection and modeling of the distal end of the clavicle in management of osteoarthritis of the acromioclavicular joint.

Also on Thursday afternoon another series of scientific motion pictures from Canada, Belgium, Great Britain, Spain and the United States was presented. On this same day the social associate members visited Hampton Court.

On Thursday evening the members of the congress and the social associate members attended a formal reception at the Royal Institution of Great Britain where we were received by the president, Lord Brabizon, viewed the equipment employed by Michael Faraday and Sir Humphrey Davy in their early researches, and then listened to a fascinatingly interesting lecture and demonstration on "Physics and Medicine" by Prof. E. N. da C. Andrade. Professor Andrade's lecture was so scholarly that it was appreciated by physicians and physicists alike, and so skillfully and clearly presented that even

the least scientific lady could enjoy it thoroughly. Everyone agreed that this was a most inspiring evening.

On Friday morning, July 18, the scientific session was devoted to a symposium on electrodiagnostic methods followed by a forum on this subject. J. Lefebvre (France) discussed the value of chronaxie in electrodiagnosis. He concluded that chronaxie measurement is a convenient method of calculating the speed of excitability. E. Kugelberg (Sweden) concluded that electromyography had become an indispensable routine method of diagnosis in hospitals admitting large numbers of patients having neuromuscular disorders. P. Bauwens (Great Britain) described technical advances in electrodiagnosis. He concluded that electronic generators of rectangular pulses of variable durations can be of the current-stabilized or voltage-stabilized pattern, and expressed the belief that the two machines are equally reliable in expert hands. During the ensuing forum under the chairmanship of F. H. Krusen (United States of America), the speakers of the morning were joined by S. Clemmesen (Denmark), and F. S. Cooksey (Great Britain). Many questions were asked of the experts on electrodiagnosis, and it was apparent that electromyography is becoming an extremely important diagnostic procedure.

On Friday afternoon a series of papers on physical measures in diagnosis and treatment was presented. A. Lundervold (Norway) described an electromyographic investigation of muscular fatigue in man. It was concluded that muscular fatigue is caused by the fact that the restitution phase in the muscle cells becomes too long in proportion to the time available, so that contractibility is reduced. C. B. W. Parry (Great Britain) discussed electrodiagnostic methods in peripheral nerve injuries and concluded that the strength-duration curves and electromyography are of considerable value in the diagnosis of, and assessment of recovery from, peripheral nerve injuries. B. O. Scott (Great Britain) described a cross-fire technique with short-wave diathermy. Two machines having slightly different frequencies were used. When a cross fire was applied to phantoms with these two machines, heating appeared first at the center and then spread to the periphery. J. B. Millard (Great Britain) discussed electrical stimulation in rehabilitation of knee injuries and concluded that it was of no value in overcoming wasting of the quadriceps muscle or in accelerating the disappearance of effusion. K. Woeber (Germany) reported on studies of the effects of ultrasonics, ultrashort waves and hyperthermia on the mitosis of Walker carcinoma. Quantitative and qualitative irregularities of mitosis were observed in each instance.

Finally, at 4:15 p. m., we came to the closing scientific session of this remarkably interesting international congress. Lord Horder, president of the congress, presided. H. A. Rusk (United States of America) gave an inspiring talk on physical medicine and rehabilitation as a service to medicine and the community. He advocated "total treatment for the disabled patient in terms of his whole problem," and recommended that the hospital should be the center of community rehabilitation services. He concluded that with dynamic programs of rehabilitation the traditional sequelae of physical disability may often be prevented and the individual trained to live and to work with what he has left. Next H. Balme (Great Britain) gave an oration on rehabilitation and international economy. He concluded that a serious international attack on physical disability depends on recognition of interested countries, adequately staffed departments of physical medicine and rehabilitation, early diagnosis of potential disability, expert medical treatment, social and psychologic aids and appropriate vocational opportunity. Then

Philippe Bauwens, secretary of the Federation, gave his final report concerning the meeting of the International Committee. Frank Krusen, president of the Federation, followed with his final remarks as retiring president. He announced that he had appointed a committee consisting of P. Bauwens (Great Britain), chairman; L. J. Michotte (Belgium), and K. M. Walthard (Switzerland) to settle problems of terminology and conflicts concerning variations in the meaning of words in the three official languages of the Federation. He announced the appointment of A. T. Richardson (Great Britain) as assistant secretary of the Federation and also announced the provisional acceptance of the associations of physical medicine of France and Yugoslavia as members of the Federation. He expressed warm admiration for and deep gratitude to Philippe Bauwens, chairman, and A. C. Boyle, honorary secretary of the congress, and the other members of the British board of management for their superb organizational arrangements and unbounded hospitality. Finally he announced that he was passing on the torch to Lord Horder who at the close of this meeting would retire as president of the congress and automatically succeed to the presidency of the Federation. Lord Horder closed the ceremonies with friendly remarks to his colleagues and thanks to his able associates and snuffed out the ceremonial lamp, to indicate the closing of the scientific sessions of the congress, and announced that it would be lit again in Copenhagen in 1956.

While these scientific sessions were drawing to a close, the social associate members had spent a pleasant day in an excursion to the Royal Naval College and National Maritime Museum at Greenwich. But still this magnificent congress had not ended, British hospitality had not ceased, and the final climax was yet to come. On Friday evening an impressive formal banquet was held at the Dorchester with many distinguished guests in attendance (fig. 3). Following this delightful dinner, the toast to Her Majesty the Queen was proposed by Lord Horder and a toast to the congress and Federation was

Fig. 3. — Banquet of the International Congress of Physical Medicine. The Dorchester, London, England, July 19, 1952.

proposed by Sir Lionel Whitby, chancellor of the University of Cambridge. The reply was made by Lord Horder. A toast to the guests was proposed by Dr. Frank Krusen, retiring president of the Federation, and replied to by Sir Walter Russell Brain, president of the Royal College of Physicians. A warm feeling of friendship and international amity spread among the 350 guests, representing twenty-two nations, who attended this banquet and who remained to exchange friendly farewell greetings during the congress ball which followed. Everyone seemed convinced that physical medicine and rehabilitation had made another tremendous stride forward and that there was promise of enormous gains in exchange of ideas and promotion of scientific investigation among the physicians of the many nations which were represented.

I quote the report concerning this congress which appeared recently in the London *Lancet*:[1] "The congress demonstrated that physical medicine has been accepted as a specialty within general medicine. . . . The speeches of Sir Cecil Wakeley and Sir James Paterson Ross at the dinner given to the national representatives by the council of the Royal College of Surgeons, and those of Sir Lionel Whitby and Sir Russell Brain, president of the Royal College of Physicians, at the congress banquet, showed that physical medicine was welcomed by the leaders of medical thought and action as a young and dynamic partner. . . . The physical medicine specialist needs to be a 'good doctor' as well as a trained clinician. . . . This is the medicine of the future, but its disciples must remember and live the warning of their president: Le malade, toujours, le malade. [The patient, always, the patient.]"

1. Editorial: International Congress of Physical Medicine, Lancet 2:187 (July 26) 1952.

THE EFFECT OF ULTRASOUND ON THE TRANSMISSIBLE WALKER RAT CARCINOMA *

JAMES D. SCHRODER, D.V.M.
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J. F. HERRICK, Ph.D.
and
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ROCHESTER, MINNESOTA

The paper by Wood and Loomis[1] in 1927 which told of the harmful and sometimes lethal effects of high frequency sound on mice, small fish, frogs and unicellular organisms was followed by reports of various investigations on the biologic effects of ultrasonic waves.† It was amply demonstrated that

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* Abridgment of thesis submitted by Dr. Schroder to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science.

1. Wood, R. W., and Loomis, A. L.: The Physical and Biological Effects of High-frequency Sound Waves of Great Intensity, Philosophical Magazine, S. 7 4:417 (Sept.) 1927.
2. Herrick, J. F.: Some Biologic Aspects of Ultrasonics, Arch. Phys. Med. 30:145 (Mar.) 1949.
3. Nelson, P. A.; Herrick, J. F., and Krusen, F. H.: Ultrasonics in Medicine, Arch. Phys. Med. 31:6 (Jan.) 1950.
4. Lehmann, J.: Die Therapie mit Ultraschall und ihre Grundlagen. In: Ergebnisse der physikalisch-diatetischen Therapie. Band 4. Dresden u. Leipzig, 1951, pp. 196-272.
5. Der Ultraschall in der Medizin. Vol. 1, 1949; vol. 2, 1950; vol. 3, 1951; vol. 4, 1952. Zurich, S. Hirzel Verlag.

† For recent surveys of the literature on the biologic effects of ultrasound and its application in medicine, the reader is referred to review papers by Herrick,[2] Nelson, Herrick and Krusen,[3] Lehmann[4] and the various papers in *Der Ultraschall in der Medizin*.[5]

necrosis of tissue may occur as the result of exposure to ultrasonic vibrations of sufficient frequency and intensity. This means of destroying tissue has been examined by a number of workers with respect to the effect on certain transmissible tumors of animals.

According to Gőzsi[6] ultrasonic energy has no effect on Ehrlich's carcinoma. Nakahara and Kobayashi[7] found that a single treatment of 1 minute's duration enhanced the growth of intracutaneous adenocarcinomas of mice but had no effect on the subcutaneous growths. Hayashi,[8] working with a rat sarcoma, reported that implants of tumor did not grow if they had been exposed to ultrasonic waves for more than 5 minutes before implantation. Later Hayashi[9] recorded that the rat tumor growing in situ was resorbed after exposure to ultrasonic energy. Namikawa,[10] using rabbit sarcomas, reported that tissue exposed for 3 minutes before implantation was resorbed, whereas a chicken sarcoma exposed "lightly" grew well; however, if this tumor was exposed for 10 minutes its growth was inhibited. Bennett[11] examined a transmissible lymphosarcoma of chickens after exposure to ultrasound and found destruction of cells only in the path of the ultrasonic waves. The rest of the tumor was not altered, and the treatment had no effect on longevity of the tumor-bearing chickens.

Woeber,[12] using doses of 1 to 2.1 watts per square centimeter at frequencies of 800 to 1,000 kilocycles, could find no beneficial effect on the Ehrlich carcinoma, on a transmissible chondroma of mice, or on the Walker rat carcinoma. However, he found that in some animals the Jensen rat sarcoma was absorbed after treatment. Dittmar[13] concluded from his experiments that the Jensen rat sarcoma could be destroyed by treatment with ultrasound, whereas the Walker rat carcinoma resisted intensive exposure. Dittmar expressed the belief that the increased temperature in the tissue played an important part in the destructive process. Hausser and associates[14] found that the Jensen rat sarcoma could be destroyed in about 60 per cent of animals that survived treatment. These workers reported that the lethal dose of ultrasonic energy for rats was not much greater than the therapeutic dose, which was at least 1,000 watt-seconds per square centimeter. In their experiments the deaths due to ultrasound varied from 15 to 62 per cent, depending on the exposure. Working with the Walker rat carcinoma Beck and Krantz[15] found that there was some inhibition of growth of tumors exposed to ultrasound as determined by weights and measurements in comparison to control tumors. Grütz[16] reported that ultrasonic waves had a specific destructive effect on the Walker rat carcinoma due to mechanical forces. Grütz stated that in some instances there was disappearance of the tumor for as long as 35 days after treatment.

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6. Gőzsi, B.: Quoted by Szent-Györgyi, A.: Chemical and Biological Effects of Ultra-sonic Radiation, Nature **131**:275, 1933.
7. Nakahara, Waro, and Kobayashi, Ryuji. Biological Effect of Short Exposure to Supersonic Waves: Local Effect on the Skin, Japan, J. Exper. Med. **12**:137, 1934.
8. Hayashi, S.: Über den Einfluss der Ultraschallwellen auf die Rattensarkomzellen. Proceedings of the Japanese Physiological Society, Sixteenth Annual Meeting, Japan, J. M. Sc. III Biophysics **5**:136, 1938.
9. Hayashi, S.: Einflüsse der Ultraschallwellen auf das Wachstum des Rattensarkoms. Proceedings of the Japanese Physiological Society. Seventeenth Annual Meeting, Japan, J. M. Sc. III Biophysics **5**:163, 1938.
10. Namikawa, Y.: Einflüsse der Ultraschallwelle auf das Kaninchen- und Hühnersarkom. Proceedings of the Japanese Physiological Society, Sixteenth Annual Meeting, Japan, J. M. Sc. III Biophysics **5**:137, 1938.
11. Bennett, W. A.: Personal communication to the authors.
12. Woeber, Karlheinz: Untersuchungen über die Wirkung des Ultraschalls auf Mäuse und Rattentumoren, Strahlentherapie **79**:563, 1949.
13. Dittmar, Carl: Über die Wirkung von Ultraschallwellen auf tierische Tumoren, Strahlentherapie **78**:217, 1948.
14. Hausser, Isolde; Doerr, Wilhelm; Frey, Rudolf, and Ueberle, Adolf: Experimentelle Untersuchungen über die Ultraschallwirkung auf das Jensen-Sarkom der Ratte, Ztschr. f. Krebsforsch **56**:449, 1949.
15. Beck, Frances F., and Krantz, J. C., Jr.: Glycolysis in Tumor Tissue. III. The Effect of Ultrasonic Vibrations on the Growth and Glycolysis of Walker Sarcoma 319, Am. J. Cancer **39**:245 (June) 1940.
16. Grütz, O.: Histologische Untersuchungen an Tiertumoren nach Ultraschalleinwirkung, Strahlentherapie **79**:577, 1949.

In view of the differences in results obtained by various workers it appeared desirable to study the effect of ultrasound on a transmissible tumor, the growth and histologic characteristics of which are well known. We report here our studies in which we could find no beneficial effect of ultrasound on the Walker rat carcinoma 256 with the maximal tolerated doses.

Methods and Materials

The Tumor. — The Walker rat carcinoma 256* was transmitted to male albino rats of the Wistar strain. The animals were approximately 3 months of age and weighed about 200 gm. each. For transmission whole tumors were removed from donor rats immediately after they had been killed by ether. Approximately 1 gm. of solid tumor tissue was cut from the periphery of the tumor, minced finely with scissors and mixed with 3 ml. of sterile physiologic saline solution. This was strained through several layers of gauze to form a suspension that would pass through an 18-gauge needle. This suspension was injected subcutaneously in 0.2 ml. amounts in the dorsal midline in animals used in the first experiment (table 1) but on the right side of the

TABLE 1. — *Summary of the Effect on the Walker Rat Carcinoma of Various Exposures to Ultrasonic Waves.*

Experiment Number	Animals*	Exposure — Watts	Exposure — Time, Min.	Remarks and Results
1	6	15	5	No shielding. Tumor on dorsal midline. All animals had paralysis immediately after exposure. Slight superficial burning. One control and 1 treated animal killed in 1, 2, 3, 4, 24 and 36 days. No gross or microscopic evidence of any inhibitory effect on the tumor.
2†	5	15	5	One animal paralyzed. Superficial burning of skin. One control and 1 treated animal killed in 1, 3, 5, 7 and 9 days. Microscopically some necrosis of skin and subcutis. No gross or microscopic difference between treated and untreated tumors.
3†	5	15	8	One animal died immediately after exposure. Two died 6 and 17 days later, respectively. Two killed in 23 and 33 days, respectively. Burning of skin, subsequent loss of hair. Tumors of untreated animals killed when treated animals died were similar in size and microscopic appearance to those treated.
4†	11	15	10	Three died in 15 minutes, 3 in 3 hours and 1 in 8 days. Four killed in 21 days. Burning and hemorrhage of skin and subcutis. Hemorrhages on intestinal serous surface, and hemorrhage and desquamation of mucosa. Necrosis of abdominal muscle. Areas of necrosis of tumor cells similar to the spontaneous necrosis seen in controls.
5‡	5	50	4, 5, 6, 8 and 10 respectively	No deaths. Exposure for 4 minutes produced superficial burning. The longer exposures caused extensive burning and necrosis of skin with subsequent ulceration. Tumor cells adjacent to this were also necrotic. No evidence of inhibition of growth or regression of tumor due to ultrasound.
6‡	13	50	4	No deaths. Slight superficial burning which in 1 rat became ulcerated. No detectable inhibition of growth of the tumor. Coagulation necrosis of skin and of tumor cells immediately beneath skin. No other histologic evidence of destruction of tumor.
7‡	16	50	4§	No deaths. No apparent increase of superficial destruction compared to preceding group. No evidence of inhibition of tumor.

* An equal number of untreated control animals, a litter mate of each treated rat, was used in each experiment. The tumors were exposed when they were 10 to 14 days old and measured 1 to 2 cm. in diameter.

† Tumor on right side in experiments 2, 3 and 4. Attempt was made to direct the ultrasound through the tumor only.

‡ Tumor on right side in experiments 5, 6 and 7. Animals shielded; only tumor exposed.

§ Given twice, 4 hours apart, in 6 animals.

* The tumor was obtained from Dr. John W. Green, Department of Pathology, University of Chicago, Chicago, Illinois.

animal about 1 to 2 cm. posterior to the last rib in animals used in the other experiments.

Palpable tumors were found within 5 days in about 90 per cent of recipients. In 10 to 14 days the tumors were 1 to 2 cm. in diameter. This was the age and size of tumors used for the study. As the tumors were permitted to grow they would expand to involve the entire right side of the animal in approximately 30 days. No metastatic growths were found in any animal. Superficial ulceration occurred on large pendant tumors. Areas of necrosis could be seen grossly in tumors as small as 1 cm. in diameter. Histologic examination revealed necrosis in practically all tumors regardless of size and age of the tumor. Gross and microscopic foci and confluent areas of necrosis were found in tumors of untreated animals as well as in those exposed to ultrasound (fig. 1). In no animal, however, was there any evidence of spontaneous regression and disappearance of a tumor.

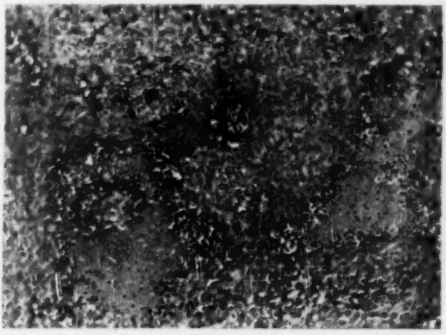

Fig. 1. — Spontaneous necrosis in Walker rat carcinoma. This change was regularly seen in all the untreated tumors as well as in those treated with ultrasound regardless of age and size of tumor (x118).

Source of Ultrasonic Waves. — The greatest part of the work was done using a Siemens sonostat (ultrasonic generator) (fig. 2), which generates sound vibrations at a frequency of 800,000 cycles per second with a maximal output of about 58 watts. The sound head as illustrated in figure 2 has a radiating surface of 10 square centimeters. A few experiments were done using a generator constructed by the Central Research Laboratories, Red Wing, Minnesota, which also generated sound vibrations at a frequency of 800,000 cycles per second with a maximal ultrasonic output of 13 to 14 watts and a sound head with a quartz crystal having a surface approximately 5 square centimeters in area.

Application of Ultrasonic Waves. — Preliminary trials in which no special attempt was made to shield the general body area indicated that protection of the spinal cord and viscera was needed. In some animals posterior paralysis and urinary incontinence developed when the vertebral column was in the path of radiation. In addition, petechiae were found on the serous surfaces of abdominal viscera of a few animals. The device shown in figure 3 was made to permit irradiation of a tumor on the right side of the animal without exposure of the body. This consists of a brass tube that fastens in vertical position to the sound head by means of a water-tight coupling. An opening in the side of the brass tube admits the tumor. The size of the opening can be varied by means of adaptors to accept tumors of different sizes.

As a contact medium, water which had been degassed by boiling and then cooled to room temperature was placed in the tube after the tumor had been inserted into the side opening. Degassed water was used to ensure the transmission of ultrasonic energy from the sound head to the tumor. A very thin

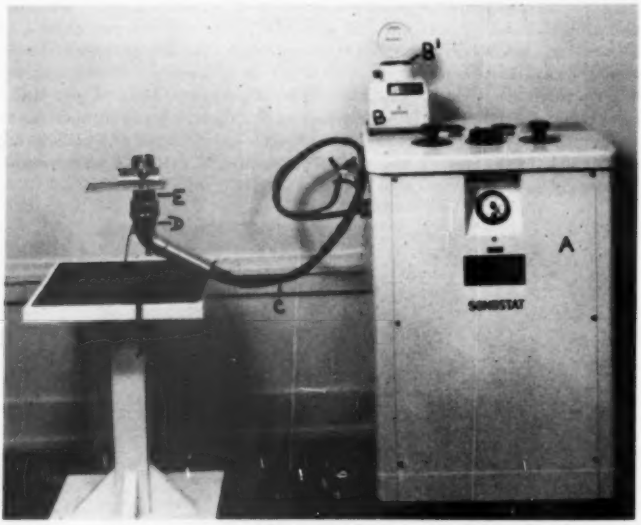

Fig. 2. — Apparatus used to expose tumor-bearing rats to ultrasound. A. Siemens sonostat. B. Siemens ultrasound power meter. B', Aperture for sound head when power measurements are made. C. Coaxial cable for transmitting high frequency oscillations to sound head. D. Sound head. E. Device for shielding rat while exposing tumor (see Fig. 3).

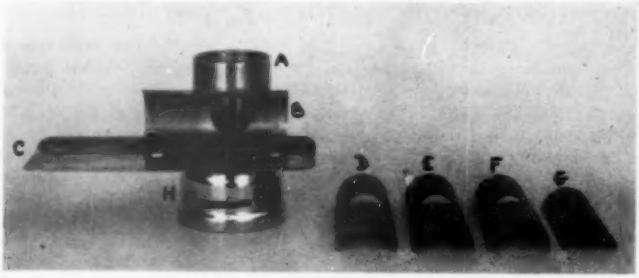

Fig. 3. — Device to shield the body of a rat while its tumor is exposed to ultrasound. A brass tube (A) is fitted with a water-tight coupling (H) which fastens in a vertical position to the sound head. The anesthetized rat is placed in a prone position on the platform (C) with the head to the left. The right side of the animal is fitted snugly into the curved shield B. The tumor, which is on the right abdominal wall, is placed into the opening so that it projects into tube A. Adaptors with varying size holes (D, E, F) are to accommodate tumors of different sizes to make a tight fit in order to prevent leakage of water. A support plate (G), which fits into spring clips at the bottom of B, is placed on the left side of the animal to hold the body snugly against the curved shield B. The tube, with the tumor projecting into it, is filled to the top with degassed water.

layer of air will absorb all the ultrasonic energy. Aerosol was applied to the shaved skin over the tumor to minimize bubble formation at the water-skin junction and make a good coupling to the ultrasonic energy.

Anesthesia of the animal was maintained during exposure to ultrasound by ether added dropwise to cotton fitted into a wire mask placed over the animal's head.

For each exposure the output of the sound head was measured before and after each treatment by means of the Siemens ultrasound power meter (fig. 2B).

To measure any increase of temperature in the exposed tumor, thermistors[17] were inserted into the tissue. The temperatures were recorded 30 seconds after the ultrasonic generator had been shut off. In living animals temperature increases were recorded ranging from 2.5 degrees C. to 18.2 degrees C. with a mean of 10 degrees C. When tumors of dead animals were exposed there was an increase of temperature ranging from 6.4 degrees C. to 17.9 degrees C. This increase of temperature was taken as proof that energy was being transmitted to the target area.

In all experiments litter mates with tumors were used as untreated controls.

Results

The data showing the number of animals in each group, the exposure, and the results are presented in table 1. The first four experiments were more or less exploratory in nature, and were done without the protective device shown in figure 3. In the first group the tumor was growing on the dorsal midline. Exposure to 15 watts for 5 minutes without body shielding resulted in paralysis which persisted for at least 5 days. There was some hemorrhage of the skin over the tumor. One treated and 1 control animal were killed 1, 2, 3, 4, 24 and 36 days, respectively, after exposure. There was no gross or microscopic evidence that the treatment had altered the growth of the tumor.

In the second, third and fourth experiments the tumors were present on the right side of the animal and an attempt was made to direct the path of the ultrasonic energy upward through the tumor without including the body. The exposures in these three experiments were, respectively, 5 minutes, 8 minutes and 10 minutes of 15 watts each in order to determine the acceptable dose. As shown in table 1 there were animals with paralysis or early deaths in each group. These effects were presumably due to the exposure of the abdominal organs and the spinal cord. Animals that died within a day were found to have petechial hemorrhages on the serous surfaces of the abdominal viscera. Subsequent microscopic study revealed congestion of the parenchymal organs and in the portions of the wall of the intestinal tract that were adjacent to the path of the ultrasonic waves. The cause of death could not be determined.

In these first four experiments the number of animals was small and was further reduced by the early deaths of treated animals. However, on the basis of size, gross appearance of cut surfaces and histopathologic examination, there was no evidence that exposure to ultrasound in the doses given had any effect on the tumors.

The greatest dose used in the first four experiments, which was 15 watts for 10 minutes, produced the greatest amount of superficial burning and necrosis of the subcutaneous tissue. In these animals, as in a few of those in other groups, there was some coagulation necrosis of superficial layers of tumor cells immediately underlying the burned skin, as shown in figure 4. In other respects the treated tumors were the same as those of untreated

17. Herrick, J. F., and Glarborg, E. A.: Application of Thermistors to Temperature Measurements in Experimental Investigations, Proc. Minn. Acad. Sc. 17:87, 1949.

animals. In animals that survived and were eventually killed the tumors were as large as those of the control animals and the latter had the same extent of necrosis and liquefaction of the tumor as did the treated animals.

When it was found that the animals could be protected against paralysis of the rear legs and petechial hemorrhage of the abdominal viscera by means of the device shown in figure 3, it was decided to increase the intensity of exposure applied to the tumors. In the subsequent experiments none of the animals showed evidence of general body exposure such as paralysis, urinary incontinence or death. In experiment 5 (table 1) the tumors of 5 animals were treated with 50 watts for periods of 4, 5, 6, 8 and 10 minutes, respectively.

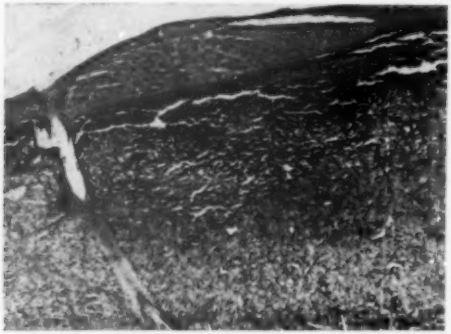

Fig. 4. — Necrosis of skin and underlying structures, including a hair follicle, two days after exposure to ultrasound of 50 watts for 4 minutes. There is also a shallow area of necrosis immediately below this portion of skin but the remainder of the tumor appears to be unaltered (x60).

Exposures longer than 4 minutes at 50 watts produced burning of the skin with subsequent ulceration and sloughing which included the surface of the tumor. There appeared to be no regression of the tumor, however. The animal whose tumor was exposed to 50 watts for 5 minutes was killed in 8 days. In spite of the extensive superficial necrosis the tumor had expanded during this period and appeared to be growing normally as compared to the untreated tumor. Microscopically there was coagulation necrosis of the skin including destruction of the hair follicles and glands as shown in figure 4. Immediately below this area the tumor consisted of a necrotic homogeneous mass with nuclear debris. This area of destruction extended into the tumor for only several layers of cells. Aside from these superficial changes, the tumor appeared microscopically to be growing normally and to be undergoing the process of ischemic necrosis as seen in the untreated animals. These changes were seen in each of the other animals in this series but were more extensive in the animals exposed for longer periods than in those exposed for shorter periods.

In the sixth experiment the tumors of 13 rats, each with 13-day-old tumors about 2 cm. in diameter, were exposed to ultrasonic radiation of 50 watts for a period of 4 minutes. Each exposed tumor was found to have a dark discoloration of the skin on the side facing the source of the ultrasonic waves. One rat was killed on the third day after exposure because of the large area of ulceration and bleeding. The remaining animals were killed at periods from 8 to 27 days after exposure. During this period each tumor

continued to increase in size in a manner comparable to that of tumors in the untreated animals. Microscopically, the tumors of the treated animals resembled those of the controls except for the destruction of the skin and necrosis of muscle and a few superficial layers of tumor cells.

The last experiment was similar to the preceding one except that in 6 of the animals the dose of ultrasonic energy of 50 watts for 4 minutes was repeated in 4 hours. This second treatment appeared to produce no greater effect with respect to burning and ulceration than was obtained by a single exposure. There was likewise no apparent inhibition of growth of the tumor as judged by gross inspection or by histologic examination.

Comment

The Walker rat carcinoma 256 developed at a uniform rate, and seldom was there any variation in the expected size of 1 to 2 cm. in diameter in 10 to 14 days. This provided the desired uniformity of material in the treated and untreated animals. It is of more than a little interest to note that no evidence of metastasis was found in any animal. It was therefore possible to expose a tumor which grew and remained at the site of inoculation without taking into consideration the possibility of distant metastatic growths that could not be reached by the ultrasonic waves. Furthermore, the absence of total spontaneous regression and disappearance of this tumor permits evaluation of therapy.

The constant presence of small foci and large confluent areas of ischemic necrosis or infarction in all untreated tumors as well as in those exposed to ultrasonic energy presented some difficulty in histologic evaluation of the effect of the treatment until one became thoroughly familiar with this natural retrogressive change. This characteristic of the Walker rat carcinoma detracted from its usefulness in this study.

There was no evidence of any selective destructive effect of the ultrasonic waves for the malignant cells, since any necrotic changes within exposed tumors could be attributed to the infarction that occurred also in the control rats. The only direct result of the exposure to ultrasound was the mild to severe burning of the skin over the exposed tumor, which, with intense energy, extended to underlying structures including muscle and a few layers of tumor cells. Even with doses that produced extensive destruction of the skin and a portion of the tumor, there was continued growth and expansion of the neoplasm from areas immediately adjacent to those which appeared to be injured. The number of mitotic figures in tumors exposed to ultrasonic waves was as great as in the untreated tumors.

Summary and Conclusions

The transmissible Walker rat carcinoma 256 was transplanted to series of rats. When the tumors attained a diameter of 1 to 2 cm. they were exposed to ultrasonic energy ranging in intensity from 15 watts for 2 minutes up to 50 watts for 10 minutes. There was no gross or microscopic evidence that the treatment had any specific inhibitory effect on the neoplasm.

Exposure of the spinal cord to ultrasonic waves produced paralysis and urinary incontinence. There were also petechial hemorrhages of the serosa and mucosa of intestinal layers that were in the path of the radiation. These complications were avoided by constructing a device which permitted exposure of the whole tumor while shielding the rat's body against the ultrasonic energy.

RELAXATION OF SPASTICITY BY ELECTRICAL STIMULATION OF ANTAGONIST MUSCLES *

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Pollock[1] defines spasticity as a condition which is "demonstrable by a sustained increase in tension over normal when the muscle is passively lengthened. The increase is felt from the beginning of the passive movement, and is in proportion to the extent to which the muscle is lengthened." On the basis of our observations we would disagree with part of this definition, since we have noticed that spasticity may be evident in a limited portion of the range and not necessarily to the extent to which the muscle is lengthened. We would rather describe spasticity as a condition of paralysis or muscular weakness associated with hyperreflexia, the symptoms of which include increased resistance to manipulation, exaggeration of the deep reflexes, and clonus.

At rest the spastic muscle may show no sign of spasticity, but the condition of rest is not always obtainable. "Both passive and active movement, as far as the latter is possible, produce a marked response in the muscle subjected to stretch by the examiner or by the patient himself" (Hoefer).[2] Spasticity over a period of time leads to shortening of the affected muscle's range of motion, and eventually to contracture. Our own experience has been that spasticity in some individuals interferes with the complete utilization of potential motor power during the rehabilitation of patients with paralysis. The exact nature of spasticity has not been elucidated. Some understanding of it, has resulted from the work of Magoun and his collaborators.[3] They compare spasticity to decerebrate rigidity as described in animals by Sherrington.[4] We concur with this as being descriptive of some types of spasticity and assume, as a result, that in these types, the spasticity is associated with the removal of affected muscle action from numerous suppressor areas in the brain. Magoun and his co-workers have also reported that the removal of inhibitory stimuli in spasticity is only part of the story and that there is every likelihood that facilitation of the involved reflexes actually occurs.

A number of therapeutic procedures are in use at the present time in the treatment of spasticity. Foerster[5] employed section of most of the posterior spinal roots conveying proprioceptive impulses from the affected extremity. This procedure, as pointed out by Magoun, attacks the exaggerated stretch reflexes in the afferent limb of the reflex arc. A second neurosurgical approach has sought to reduce the imbalance of central inhibitory and facilita-

* From the Kabat-Kaiser Institute, Vallejo, California.

1. Pollock, L. J.; Boshes, B.; Finkelman, I.; Chor, H., and Brown, M.: Spasticity Pseudospontaneous Spasms, and Other Reflex Activities Late After Injury to the Spinal Cord, Arch. Neurol. and Psychiat. **66**:537, 1951.

2. Hoefer, P. F. A.: Diseases of the Basal Ganglia, Chapt. XII, Physiology of Motor Innervation in the Dyskinesias, Baltimore, 1942.

3. Magoun, H. W., and Rhines, R.: Spasticity: The Stretch Reflex and Extrapyramidal System, Charles C Thomas, Springfield, 1947.

4. Selected Writings of Sir Charles Sherrington, edited by Denny-Brown, D., Paul B. Hoeber, Inc., New York, 1940.

5. Foerster, O., und Altenburger, H.: Zur Physiologie und Pathophysiologie der Sehnen-und Knochenphanomene und der Dehnungsreflexe. I. Mitteilung: Zur elektrophysiologischen Analyse der Sehnen- und Knochen-Phanomene bei Gesunden., Ztschr. f. d. ges. Neurol. u. Psychiat. **146**:641, 1933.

tory influences operating on the reflex arc by cutting down the number of facilitatory connections reaching the spinal gray matter. As Magoun states, "Its efforts have so far met with only transient or partial success for the apparent reason that facilitatory influences are conducted in the cord by three separate pathways whose inclusive distribution encompasses all the spinal white matter outside the posterior columns. Interruption of the cortico-spinal (Putnam[6]), or vestibulo-spinal (Bucy[7]) tracts alone has not prevented spasticity. Partial interruption of facilitatory reticulo-spinal connections (Hyndman[8]), has caused some lasting reduction in spastic symptoms, but these descending connections from the reticular formation unfortunately appear to be distributed so diffusely in the cord that their complete interruption might, in relieving spasticity, unavoidably sever so many other paths as to leave the patient in a more incapacitated state than before."

We have reported that relaxation of muscle spasticity can be brought about with the aid of therapeutic techniques of active exercise,[9] and through the use of pharmacologic agents.[10] Heat, passive stretching and other stock procedures have been used with a degree of success. Electrical stimulation has been employed for almost 100 years by various workers in the treatment of this condition. Most commonly the stimulation is of the spastic muscle, and beneficial results have been attributed to fatigue. It is interesting, however, to note that as far back as 1871 Duchenne[11] employed stimulation of the antagonists to relieve spasticity, although at that time he could not have been aware of the rationale of such an approach.

For some time we have been studying the dynamics of voluntary movement in man. During the course of this investigation, we have had the opportunity to reassess the importance of reciprocal innervation in voluntary movement. The details of this study are published elsewhere.[12] We may summarize our results by stating that in normal voluntary human movement there is at present insufficient evidence that reciprocal innervation plays the role in the co-ordination of the contraction of antagonistic muscles which is assumed for it by most current thinking on kinesiology. Co-contraction seems to be the rule rather than the exception. It is quite possible that reciprocal innervation is important in volitional movement, but the mechanical translation of Sherrington's phenomenon to voluntary movement is not justified.

Most of Sherrington's experiments were performed on muscles in either spinal, decerebrate, or anesthetized animals. Under such conditions, he was actually studying reciprocal innervation in the reflex state. He made some attempt to study the phenomenon in volitional movements of the eye muscles of the monkey, but the results were actually inconclusive. During the course of our studies, we assumed that reciprocal innervation should be demonstrable in the human in certain reflex states such as spasticity. Sherrington has reported that in the decerebrate animal, relaxation of the antagonist could be observed following faradic stimulation of the motor nerve of the agonist. With this in mind we applied this form of electrical stimulation to the mus-

6. Putnam, T. J.: Treatment of Unilateral Paralysis Agitans by Section of the Lateral Pyramidal Tract, Arch. Neurol. & Psychiat. **44**:950, 1940.
7. Bucy, P. C.: Studies on the Human Neuromuscular Mechanism. II. Effect of Ventromedial Chordotomy on Muscular Spasticity in Man, Arch. Neurol. & Psychiat. **40**:639, 1938.
8. Hyndman, O. R.: Physiology of the Spinal Cord. II. The Influence of Chorodotomy on Existing Motor Disturbance, J. Nerv. & Ment. Dis. **98**:343, 1943.
9. Kabat, H.: Studies on Neuromuscular Dysfunction, XIII: New Concepts and Techniques of Neuromuscular Reeducation for Paralysis, Permanente Foundation Bulletin, Vol. VIII, No. 3, July, 1950.
10. Kabat, H.: Studies on Neuromuscular Dysfunction. I. Neostigmine Therapy of Neuromuscular Dysfunction Resulting from Trauma. II. Neostigmine Therapy of Hemiplegia, Facial Paralysis and Cerebral Palsy. III. Neostigmine Therapy of Chronic Rheumatoid Arthritis and Subacromial Bursitis, Public Health Rep. **59**:1635, 1944.
11. Duchenne, G. B.: Selections from the Clinical Works, edited by Poore, G. V., London, 1883.
12. Levine, M. G., and Kabat, H.: Co-contraction and Reciprocal Innervation in Voluntary Movement in Man, in press.

cles antagonistic to those showing spasticity in patients with neuromuscular disease. We were able to observe the same relaxation which Sherrington had observed in his experiments on reciprocal innervation.

Method

A fairly large (at least 3 by 4 inches) moist pad dispersing electrode is placed on a portion of the body at a distance from the part to be stimulated. An active small moist pad electrode (1 inch in diameter) is placed in good contact with the skin over the middle of the muscle belly on the motor point, or on a point which gives a maximum contraction. Faradic stimulation with a frequency of about 100 per second is employed to give a tetanic contraction. The intensity of the current should be sufficient to give a maximum contraction. The active electrode is kept on the motor point until the antagonist relaxes. Relaxation may not begin until a number of seconds have elapsed, and then appears to be cyclic, so that if the tetanizing current is maintained for a period of time, progressive relaxation appears to be spaced at intervals. The cause for this is under study at the present time. When the electrode is applied, the part is carried passively and slowly through the desired range of motion. Relaxation should precede forceful movement through the range, whether by voluntary effort of the patient or through passive movement by the therapist. The persistence of the effect, which is apparent in the patient treated, depends on taking advantage of the relaxation to carry the part through its full range of motion. Maximum relaxation and its persistence depend on completing as much as possible of the range during relaxation. As an illustration of the procedure, the following example may be helpful: If spasticity of the triceps prevents full flexion of the elbow, the active electrode is placed over the motor point of the biceps with current of sufficient intensity so that a full contraction of the biceps is observed. If the patient has voluntary control, he is told to assist the therapist in carrying the limb through its maximal range of flexion. It is important that the voluntary or passive flexion accompany the relaxation rather than precede it, since force applied against the spastic extensor before relaxation occurs merely increases the spasticity. The electrode is kept on the biceps for as long as one minute or more depending on whether complete relaxation has occurred. It is possible to judge relaxation in two ways: If the spasticity is constant, it impedes movement. Constant pressure on the forearm during passive flexion should cause the therapist to feel the arm "give" when relaxation occurs; another method, in the same example, is to feel the decrease in spasticity during rapid passive flexion. Normally, without relaxation, during rapid passive flexion, the movement will be impeded at one or more points because of the spasticity of the extensors. If the same movement is made with the electrode on the biceps, the impedance is reduced or eliminated.

It is also important in obtaining the full range of motion to carry the part through its normal pattern of movement. In the case of flexion of the elbow, for example, maximum range is best obtained when the forearm is supinated during elbow flexion while the shoulder is flexed and adducted. Such patterns of movement have been described in previous reports.[8]

Results

We have tried this form of relaxation in a large number of patients with spasticity and with a variety of neuromuscular diseases. The immediate response of relaxation of spasticity is very evident. The persistence of the relaxation effect appears to depend on the amount of relaxation which occurs

at the time of stimulation and on the individual patient. Spasticity may not be confined to one muscle so that it is important to diagnose the exact muscles involved and to determine empirically the antagonist to be stimulated. A number of representative case reports will illustrate the response.

Patient A. W., age 25, male, diagnosis — left hemiplegia following an auto accident on October 16, 1948. Initially there was complete paralysis of the left upper and a good deal of weakness in the left lower extremity. When he was seen in July, 1949, marked spasticity was present in the upper extremity, less in the lower. The upper extremity was completely paralyzed except for slight motion in the shoulder. The leg showed considerable weakness. Over a period of four months, treatment resulted in improvement in function of the lower extremity and restored to a degree the gross motions of the shoulder and elbow. The wrist and fingers, however, were still severely paralyzed, with only a trace of voluntary extension. A slight decrease in the spasticity of the wrist and fingers was evident. Short periods of therapy followed at scattered intervals, and by December, 1951, the patient's main problem was the spasticity of the wrist and fingers. With attempted extension of the wrist, the fingers went into automatic flexion and over a period of time became fixed in flexion. At this time, the problem of finger nails digging into the palm of the hand was of great practical importance. Spasticity of the shoulders and elbows was still present.

To relieve the spasticity of the flexors of the wrist and fingers, the radial nerve was stimulated above the elbow as were the long extensors and interossei of the fingers. At the elbow, the spastic flexors were relaxed by stimulation of all three heads of the triceps. Shoulder spasticity in the posterior deltoid and latissimus muscles was relaxed by stimulation of the pectoralis major and the anterior deltoid. Relaxation of the fingers followed immediately and lasted over a period of time if the patient passively extended them. While the patient was under observation for a period of three months, his spasticity never returned to what it was before electrical stimulation, however, there was a gradual return from the complete relaxation immediately following the stimulation. Since this patient had no voluntary control in the fingers, it became necessary to seek some method for maintaining the relaxation. Repeated electrical stimulation would serve this purpose; but since this was impossible in practice, it was found that the patient could maintain his relaxation over an extended period of time by submerging the hand and wrist in hot water (about 100 degrees F.) for fifteen minutes whenever indicated. No other form of therapy was used on the patient so that we were able to study the effect of electrical stimulation in a fairly well-controlled situation.

Patient F. T., age 39, male, in 1948 had a right hemiplegia as a result of a cerebral accident. Six months later gangrene of the right leg necessitated amputation. The patient was first seen in October, 1949, at which time a tentative diagnosis of thromboangiitis obliterans was made, a diagnosis which was confirmed pathologically when gangrene required the amputation of the other leg in 1951.

When first seen, the patient's right upper extremity showed paralysis with marked spasticity but with residual voluntary control in all motions. There was marked limitation of range of movement in the shoulder and elbow. There was spasticity in the pectoral, posterior deltoid and latissimus muscles, with more spasticity in the pectoral than in the others. At the elbow, spasticity was present in the triceps and biceps but more marked in the biceps. There was considerable weakness in flexion and extension of the fingers and wrist with marked spasticity in the wrist and fingers in both flexion and extension, with more in flexion. The wrist was held in the neutral position but the fingers and the thumb were partially flexed.

Over a period of time physical therapy increased the range of motion as well as the power at the shoulder and elbow, and to a lesser extent at the wrist and fingers. Electrical stimulation was begun on December 10, 1951, on the following muscles: the anterior deltoid, the pectoralis major, the posterior deltoid and the latissimus muscles, with emphasis on the posterior deltoid and the latissimus. At the elbow, the triceps and biceps were stimulated with more emphasis on the triceps. At the wrist, the extensors and flexors were stimulated with emphasis on the extensors. The patient attained considerable relaxation at the end of three days of stimulation. The shoulder improved so that the patient was able to improve abduction from 40 per cent previous to stimulation to 75 per cent of the normal range after stimulation. The elbow which formerly could be extended to about 60 per cent of complete extension, after stimulation gave the normal range of extension. Flexion at the elbow increased from 75 per cent before stimulation to 95 per cent of normal after stimulation. The fingers and the wrist could be completely extended after stimulation, whereas previously latent voluntary

power was masked by the spasticity. Complete flexion was possible in the wrist and fingers without the effort necessary previous to stimulation. Pain at all joints associated with the spasticity was relieved. There was a slight residual of spasticity in the index finger and the thumb, which was relaxed after further stimulation.

The patient received a constant amount of resistive exercise before and after the electrical stimulation so that it was possible to control the effect of the stimulation. No other methods of relaxation were employed in this or any of the other patients mentioned in this paper.

Patient C. K., a 23 year old male miner, diagnosis incomplete paraplegia, was crushed from above by a rock fall in March, 1951. When the patient was seen in July, 1951, a diagnosis was made of compression fracture of T-9 and L-2 with severe comminution of the latter. The basic sensory level was found to be L-2 on the left and L-5 on the right. His upper extremity and neck showed generalized weakness and a slight disuse tremor. Muscles of the trunk were fair. His upper reflexes were slightly depressed, the lower absent, and the cremasteric sluggish. The lower abdominal reflexes were hyperactive. The hip flexors and the quadriceps on the left side showed a flicker of activity. On the right there was a fair contraction of the sartorius, hip flexors, adductors and quadriceps. By February, 1952, after intensive treatment, the patient was able to do a four-point gait pattern with long leg braces and crutches for a distance of at least 500 feet and had learned to get in and out of his wheel chair. He had obtained a fair degree of bladder control, being able to hold his urine for up to six hours.

In this patient marked spasticity of the hip and knee extensors as well as in the hamstrings made self-care difficult. He was unable to dress himself or to move freely. As a matter of fact, spasticity of the hamstrings made it difficult to obtain the full potential of muscle power which existed in the extensors of the knee. Pain was a problem whenever the hamstrings were stretched either through voluntary or passive movement. Pain also interfered with passive or voluntary stretching of the hip extensors. Electrical stimulation of the quadriceps and iliopsoas made it possible to stretch the hamstrings without pain, so that the patient was able to achieve adequate range of knee extension permitting more complete rehabilitation. In addition to improvement in power and range of muscle activity, the patient was better able to dress himself and to utilize his wheel chair as a result of the relaxation of the spasticity. No other methods for relaxation of spasticity were employed in this patient at the time of the experiments on electrical stimulation.

Although in the partial paraplegic spasticity may not always mask potential motor power, the importance of relaxing spasticity so that the full range of passive motion of a joint can be attained must be emphasized in these cases. Contracture becomes a real problem in these individuals even without appreciable voluntary control.

Patient S. S., 46 year old male, diagnosis multiple sclerosis, developed muscle weakness in 1939 which progressed until he had a spastic quadriplegia, with marked spasticity of both lower and upper extremities as well as of the trunk. An intensive daily physical therapy program supplemented with gymnasium and gait training, as well as occupational therapy resulted in considerable improvement, so that by March, 1950, he was able to stand on crutches independently and walk with a little assistance. There was improvement in his arms, hands, and trunk both in range of movement and in power. There was little or no improvement in the lower extremity because of severe spasticity evidenced in all directions of motion. The patient could not sit in a chair properly because he was unable to flex his hip or his knees adequately, and a pillow had to be used to separate the knees as a result of adductor spasticity.

Electrical stimulation of the psoas and tensor resulted in improvement of hip flexion and relaxation of the spasticity in the adductors while stimulation of the hamstrings relaxed the spasticity at the knees and permitted unimpeded flexion of the joint. The resulting improvement in the sitting posture enabled the patient to function more adequately in the various activities constituting self-care. No other type of relaxation procedure was used in this patient at the time of the experiments on electrical stimulation.

This last patient illustrates an interesting phenomenon which is apparent in such cases. After treatment, long leg braces were necessary to accomplish standing, whereas previously he was able to stand erect because of the spasticity in the hips and knees. Where voluntary control of the extensors of the knee and hip is not adequate to attain an erect posture, spasticity may result in sufficient contraction of these muscles so that the patient is able to stand. In such a case the spasticity is actually of value to the patient. Frequently,

a decision must be made whether the relaxation will prove beneficial or will interfere with certain practical functions such as standing. In this last patient the sitting position was more important for rehabilitation than was unaided standing, so that we felt the attainment of a proper sitting position necessitated the relaxation in spite of the fact that long leg braces would have to be supplied to permit proper standing.

We have stated above that spasticity may mask potential voluntary movements. There are other times, however, when spasticity facilitates contraction. We have observed this, and Twitchell[13] has remarked on it in his studies on the restoration of motor function following hemiplegia in man: "It has often been assumed that if spasticity could be abolished, willed movement could be more effectively performed. Though this might be possible in certain spinal disorders, the present studies indicate that the first movements to appear following hemiplegia are themselves facilitated stretch reflexes. The problem at that stage is not so much to abolish the spastic reaction as to harness its diffuse hyperactivity."

Spasticity becomes a problem which must be considered individually in each case. At times its facilitating effects must be emphasized, whereas at other times quite obviously its elimination increases voluntary control. Added to these factors is the problem of contracture and range of motion, all of which must be considered in prescribing in relation to spasticity.

Summary

A number of procedures are at present employed in the treatment of spasticity. None of these is completely adequate, so that there is a need for further exploration of therapeutic approaches to the problem. In this regard, we have developed a procedure involving faradic stimulation of muscles antagonistic to those showing spasticity. The resulting relaxation, we feel to be due to reciprocal innervation.

13. Twitchell, T. E.: The Restoration of Motor Function Following Hemiplegia in Man, Brain 74:443, 1951.

ELECTRICAL STIMULATION IN THE TREATMENT OF INTRACTABLE STRESS INCONTINENCE *

A Preliminary Report

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In recent years increasing interest has developed in the non-operative management of stress incontinence. Physical exercise of the perineal muscle and connective tissue structures which play major roles in the voluntary inhibition of urination has been particularly emphasized. A small group of patients, however, because of anatomic, pathologic or psychic factors, are unable to exercise because they can not contract those anatomic structures involved in the voluntary inhibition of urination. This is a preliminary report of the results obtained in the study of such a group of women. Treatment consisted of electrical stimulation of perivaginal musculofascial structures involved in the voluntary inhibition of micturition. Volitional exercise therapy was used in conjunction with the electrical stimulation.

The actual mechanism of stress incontinence is not well understood and will remain a matter for conjecture until more is known about the anatomical and physiological factors which control inhibition of micturition. The involuntary escape of urine from the bladder as the result of effort accompanying sneezing, coughing or straining is usually explained as being due to injury of the voluntary urethral sphincters.

A special clinic for stress incontinence patients has been conducted by the Department of Obstetrics and Gynecology in conjunction with the Department of Urology at Northwestern University Medical School. A number of patients were seen in the clinic who had no ability to contract the structures used in inhibition of urination. Among them was a group who had no discoverable neurological or urological cause for their incontinence. Several of them had been unsuccessfully operated upon a number of times. The absence of perineal muscle contractility in these patients seems closely related to the inability of any voluntary muscle to contract when partially or completely denervated. It was thought, therefore, that by means of electrical stimulation it might be possible to develop the necessary muscular structures, and, in addition, initiate volitional effort.

Seventeen patients were selected to test this hypothesis. They were divided into two groups.

Group 1. — It was arbitrarily decided that the eight patients in this group would be given treatments twice weekly for a period of at least ten weeks unless their progress was such that further treatment would be deemed unnecessary. A modulated sinusoidal

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† Dr. Osborne died October 24, 1952.

current with a carrier frequency of 3 to 25 cycles per second was used.[1] Electrical stimulation was given for a period of five minutes at a rate of 12 to 24 contractions per minute. The active or stimulating electrode consisted of a metal cylinder which, with the exception of the section in contact with the tissues to be stimulated, was insulated with a rubber finger cot. This electrode was placed within the introitus, in contact with the vaginal mucosa, at the level of the musculofascial bundle which is contracted during voluntary perineal exercise. Surgical lubricating jelly was applied solely to the uninsulated section of the electrode which came in contact with the tissues to be stimulated. The dispersive electrode was placed beneath the dorso-sacral region. The current intensity was gradually increased until contraction and relaxation of the involved structures could be seen. When possible the current intensity was increased to the patient's maximum tolerance. All of the patients did not respond maximally to the same carrier frequency. When there was an excessive deviation from the optimal frequency there were vigorous contractions of the contiguous pelvic and thigh muscles. As soon as the patients were able to sense the rhythm of the stimulation, instructions were given to synchronize volitional effort with the contractions produced by the electrical current. When electrical stimulation was terminated the patients were requested to exercise without the aid of the current. As soon as they were able satisfactorily to perform volitional exercise, electrical stimulation was no longer used.

After ten treatments, four of the eight patients were able to exercise voluntarily. Electrical stimulation was discontinued and they were placed on the usual exercise regime. At the end of three months all of the patients in this group were reexamined. Three of them were free of incontinence. Two patients were greatly improved; although they had slight incontinence with severe stress, it was no longer a problem. Three of the group apparently were not benefitted.

Group 2. — The nine patients in this group were given daily treatments five days a week for three months unless their progress was such that further treatment was deemed unnecessary. The technique of treatment was identical with that of Group 1 except for an additional period of stimulation administered externally to the perineum. That phase of the problem is still under investigation.

The women in this group presented a variety of clinical problems. They had one complaint in common, which was stress incontinence. Also, they all had an inability to perform perineal exercises. Several of them had been given a trial with an intravaginal balloon without success. Most of them had had one or more unsuccessful surgical attempts to relieve incontinence.

The following case histories will illustrate the diversity of problems which were presented by this group of women.

Patient 1. — Mrs. M., 54, gravida XVI, para XV, was admitted with persistent dribbling to gushing incontinence aggravated by modest effort. Examination revealed a moderate cystourethrocele and rectocele. Two previous surgical attempts at relief, both vaginal, were unsuccessful. She had no contractile ability. Attempts at exercise with and without an intravaginal balloon were unsuccessful. Electrotherapy as described was instituted daily, five days a week. The patient noted improvement after three weeks. Muscular contractions were evident at that time. After 12 weeks incontinence was present only on severe stress. She was exercising effectively. By voluntary contraction the intravaginal pressure could be raised to 40 mm. Hg.

Patient 2. — Mrs. S., 42, para III, gravida III, was admitted with a history of constant dribbling incontinence of two years duration. She had had multiple operations for repair of a surgical vesico-urethral vaginal fistula. Although the fistula was closed the urethro-vaginal septum was composed chiefly of scar tissue. She had little contractile ability (intravaginal pressure with effort, 2 mm. Hg.) despite many months of exercise with and without an intravaginal balloon. Electrotherapy was instituted. After twelve weeks of five treatments weekly, incontinence was markedly improved. There was a definite increase in the thickness and tone of the urethro-vaginal tissues. Intravaginal pressure with effort could only be raised to 5 mm. Hg. Although slight incontinence was still present, with moderate effort she was no longer incapacitated by constant dribbling.

Three months after treatment all nine patients were examined to ascertain the result of the therapy. It was found that four were free of stress

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Personal Communication.—1. Since this work began we have learned that similar studies were being made by H. A. Burt, and J. Cooksey of King's College Hospital, London. [2] Bathurst and [3] Clayton outline similar methods of treatment. They, however, use and advocate a surging faradic current for the electrical stimulation rather than a sinusoidal current of low variable frequency.

2. Bathurst, L. W.: Incontinence of Urine in Women Treated by Electrotherapy, The Med. Standard **52**:17, 1929.

3. Clayton, E. B.: Electrotherapy and Activotherapy, The Williams and Wilkins Co., Baltimore, 1949.

incontinence, two were markedly improved, and three were unimproved.

Summary and Conclusions

A preliminary report is presented of the results obtained in the treatment of intractable stress incontinence by electrical stimulation of the perivaginal musculofascial structures involved in voluntary inhibition of urination. The electrical stimulus, applied intravaginally, was a modulated sinusoidal current of variable carrier frequency. The first group of eight patients, treated twice weekly for five weeks or until volitional muscle contractions could be obtained, had the following results: Three were cured of their incontinence; two were improved; three were not benefitted. A second group of patients were given intensive treatments, five days a week for three months, or until volitional muscle contractions could be obtained. Four of the nine were cured of their incontinence; two were improved; three were unimproved.

It appears from the preliminary investigation that electrical stimulation of the perivaginal musculofascial structures involved in the voluntary inhibition of urination offers a possible means of relieving intractable stress incontinence in selected cases.

BIOPHYSICAL BASIS FOR THE SELECTION OF FUNCTIONAL BACK BRACES *

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Great confusion still exists regarding the etiology of chronic back pain; and, despite the extensive investigation of anatomy, physiology, and pathology of the spine, it is impossible to determine with certainty how and from where the pain originates. The scope of this paper will be limited to back conditions without permanent gross structural deformities. The possible causes of these conditions are too numerous for appraisal in so limited a time. So are the various methods of therapy, but it is generally accepted that, except in rare cases, all, at first, should receive conservative treatment. This consists of rest, medication, application of heat, massage, exercise and braces.

The main disability in back conditions is pain, occurring in certain definite regions of the spinal column, and localized there by the factors of mechanical strain resulting from the upright position of man. These areas of greatest stress are found where there is a change of direction of mechanical forces, namely, at the junctions and the apices of the curves. If the normal limits of stress and strain are exceeded, pathological manifestation occurs. The result is pain, which is localized in these areas of greatest stress.

In analyzing the disability of the back, emphasis should be placed on the function of the spine as a whole, or at least on its regions as units, considering the individual segments only so far as they influence this function. The amount of movement possible between any two adjacent vertebrae is very small; but, by the summation of these movements aided by the compressibility of the intervertebral discs, the vertebral column, as a whole, acquires a moderately extensive range.

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Because of the conjoined action and elasticity of its structures, the spine, in a healthy state, follows Hooke's law, which postulates that most bodies can yield a little and recover their original condition perfectly when the deforming force is removed. Within this limit, the body is said to be elastic and the effect produced is proportional to the cause producing it. If, however, the original cause of deflection should have been some morbid condition by which the elasticity of the column at a given point has been damaged or interfered with, then pathologic change may occur. This change may be small and may involve any of the structures composing or supporting the spinal column; and, because of the influence of gravity, it results in a certain amount of disalignment with consequent shift in the center of gravity.

When the spine has become abnormally deflected, however slightly, the weight of the superincumbent load of the head and the shoulders tends to maintain and exaggerate this malalignment. This is associated with an alteration of the normal position of the pelvis relative to the spinal column when the body is in the erect position. Muscle imbalance, whether as a cause or as a result, is another important factor in the production or maintenance of malalignment.

Basically, the object of a functional back brace is not to support the body load but to maintain, as normal as possible, the postural alignment. This should result in restoring weight-bearing stability of the spine, and relatively normal transmission of the forces of gravity and weight. The brace should correct malalignment and should preserve the maximal optimal function. Selection of a brace should be based upon a careful analysis of the disability and an accurate calculation of the kind, direction and amount of force required. The brace should prevent, if present, any abnormal mobility between vertebral segments, and should relieve the pressure or tension on the affected parts of the back. It should correct the excessive and imbalanced action of particular groups of muscles, which tend to fix or maintain the malalignment. It should also correct the position of the pelvis with reference to the spine and, further, prevent aggravation of the disability by direct exercise of mechanical force.

To be of any value, all spinal braces should be constructed on the "three-point" pressure system.[1] Two forces are used for stabilization and the third, applied between and counteracting these, is the kinetic force. The stabilizing forces should exert their pressure on the extremities of the spinal segment to be braced. Unfortunately, owing to the mobility of the interposed soft tissues, the mechanical forces cannot act directly upon the spine. Because of this interference, a considerable amount of the corrective forces is lost.

The kinetic force should be applied just below the apex of the curve. This tends to counteract gravity much more effectively, requiring less mechanical force than if the kinetic force were applied above the apex of the curve. Force applied in such a position tends to exaggerate the disability. Another important factor is to apply this active force as perpendicularly to the spinal curve as conditions will permit.

Braces for Prevention of Excessive Anterior Curves of the Spine

The primary region where an excessive anterior curve of the spine can occur is the lumbar area. Functional anterior curves of the dorsal spine are almost non-existent. An anterior lumbar curve produced by an excessive extension or hyperextension of the lumbar spine is usually associated with a protruding abdomen and with a downward and forward tilting of the pelvis. Extension of the lumbar spine normally causes narrowing of the interverte-

1. Jordan, Henry H.: Orthopedic Appliances, New York, N. Y., Oxford University Press, 1939.

bral foramina, which may cause compression of structures within it. The spinal canal becomes shorter. The meninges, cauda equina and nerve roots become relaxed. The nucleus pulposus is displaced anteriorly. During this movement the weight is transmitted through the articular and spinous processes. In extreme hyperextension, some backward sliding of one vertebra on the one below may occur.

The superincumbent weight of the body, in addition to other factors, tends greatly to increase the lordosis once it has been established. The essential feature of treatment is the restoration of normal alignment of the spine by correcting this excessive anterior curve. Theoretically, this can be accomplished by applying the kinetic force of the brace anteriorly and the two stabilizing forces posteriorly. This basic principle was suggested by Bigg.[2] The only objection to his brace is the use of axillary crutches, which tend to exert pressure in an unphysiologic manner.

The brace that has the best biophysical basis for correction of the excessive anterior lumbar curve is the Williams brace.[3] It is so designed that it permits free anterior flexion, but prevents extension and lateral bending of the lower lumbar spine (Fig. 1). The stabilizing forces are applied over

Fig. 1. — Williams' Brace.

the sacral spine and the thoracic spine just above the dorso-lumbar junction. The kinetic force is applied through a lower abdominal pad, attached to an abdominal support. The upper transverse bar has lateral uprights attached at each end. These lateral uprights are hinged at about the junction of the upper one-eighth of their length with diagonal bars of the pelvic band. The lower ends of the lateral uprights are free. Attached to them are pull straps, which run back to the ends of a short pelvic band, where their direction is reversed forward by metal rings, and finally they are fastened in front to the abdominal pad. Tightening these straps pulls the distal ends of the side bars

2. Bigg, Henry Heather: Orthopraxy, London, J. & A. Churchill, 1877.
3. Williams, Paul C.: Lesions of the Lumbo-Sacral Spine, J. Bone & Joint Surg. 19:690, 1937.

backward. This force is transmitted to the upper ends of the lateral uprights, and it is reversed in its direction at the hinge. This results in the upper transverse bar being actively forced forward. As a general rule, this brace is quite comfortable to wear though it needs frequent adjustments.

In mild cases of disability, the so-called sacroiliac braces, as developed by Goldthwaite[4] and Meyerding,[5] are useful. These stabilize the lower lumbar spine and apply a kinetic force through an abdominal apron or pad. The most commonly used brace is a modified Goldthwaite brace (Fig. 2). If prop-

Fig. 2. — Goldthwaite Brace.

erly constructed, it is an efficient device. It is made of two rigid metal back uprights, which extend from about an inch below the lower angle of the scapulae to the sacrum. These uprights are placed on either side of the midline of the back and about 3½ inches apart. Three short transverse metal pieces connect them for stability. Straps are riveted to each end of the transverse piece and are attached to an abdominal pad about 6 inches across and 4½ inches long, placed just above the symphysis. The back metal uprights should not conform to the lordotic position of the spine but should be practically straight and bridge this area. By applying pressure on the abdominal pad, the kinetic force is directed backward and upward toward the upright bars, resulting in a straightening of the spine.

There are other braces used for this purpose, such as the Lipscomb brace,[6] the Wilcox brace[7] and chair back brace. The Lipscomb brace (Fig. 3), is more comfortable to wear than the chair back brace as it fits more snugly against the ribs. This brace eliminates lateral flexion. It differs from the chair back brace only in that the upper transverse bar is divided into three separate segments, one for each lateral upright, placed in line with the greater trochanter, and one for the back uprights. All of these are hinged to each other so that they move back and forth. The transverse bar is usually

4. Goldthwaite, J. E.; Painter, C. F., and Osgood, R. B.: Diseases of the Bones and Joints; Clinical Studies. Boston, Mass., Heath, p. 543, 1909.
5. Meyerding, Henry W.: Spondylolisthesis as an Etiologic Factor in Backache, J. A. M. A. 111: 1971, 1938.
6. Lipscomb, William R.: Personal communication.
7. Hadden, C. C.: Proc. First Sympos. on Orth. Appliances. Published by OALM Assn., Washington, D. C., 1948, p. 35 (Wilcox Brace).

at the level of the tenth dorsal vertebra, though it may extend to the axillae. Each lateral upright has a pressure pad on a swivel, about 3½ inches in diameter. Pressure on the abdomen is exerted by an abdominal apron. This brace should be worn with perineal straps. The Wilcox brace has essentially the same construction, though it does not use pressure pads. These braces are tolerated well by patients.

Braces for Prevention of Excessive Straightening or Posterior Curve of the Spine

The spine can be affected so that it may show either a straightening of the lumbar area or a posterior curve in the dorsal region. These disabilities are produced by flexion of the spine.

Forward bending of the upper spine causes anterior compression of the intervertebral disc with posterior displacement of the nucleus pulposus. Each

Fig. 3. — Lipscomb Brace.

vertebra above the axis of the curvature is placed in an oblique position with an antero-inferior direction. Should pressure of any kind be made above the apex of the curve, the deformity would be increased because it would cause a further compression of the curve upon itself in a downward direction. Therefore, it is imperative to apply the kinetic force below the apex of the curve. This may be difficult in a high dorsal deformity because the leverage against which the upper stabilizing force and the kinetic force can play is short.

The essential feature of treatment of a symptomatic posterior dorsal curve or straightening of the lumbar spine is the restoration of the normal account of kyphosis or lordosis, respectively. Theoretically, this requires the application of kinetic force from the posterior aspect and the stabilizing forces in the front. Anatomically, the only stabilizing points on the anterior body surface through which pressure can be applied to the spinal column are the symphysis pubis and the thoracic cage. When pressure is exerted on the

symphysis, it tends to tilt the pelvis downward and forward, increasing the lumbar lordosis. The application of pressure on the upper part of the sternum is preferred as this interferes to a lesser degree with normal respiratory movement and still provides a good stabilizing point.

There are several braces that meet these requirements. One is the Baker hyperextension brace,[8] which can be modified for use in the lumbar region (Fig 4). Essentially, this modification consists of lowering the posterior pad

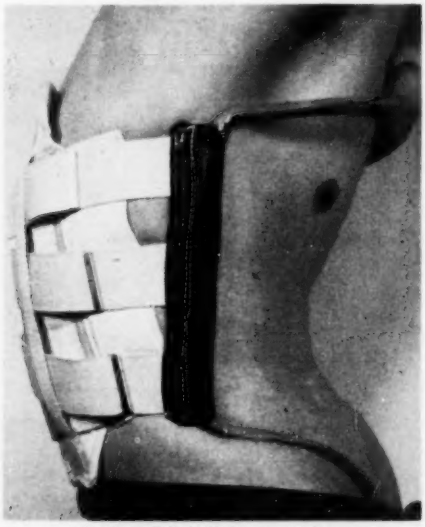


Fig. 4. — Baker's Hyperextension Brace.

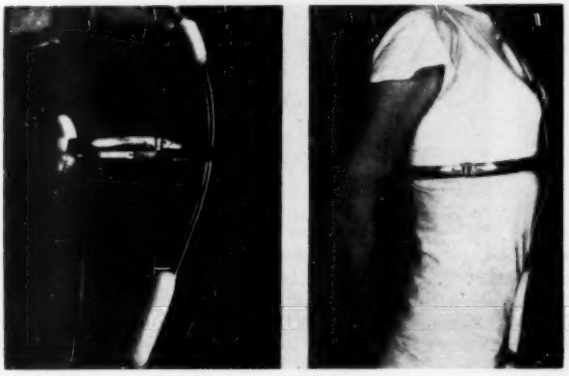


Fig. 5. — Callahan Brace.

and band by placing it at or just below the apex of the curve to be corrected. The degree of hyperextension is controlled by the tension of the back band.

8. Baker, Lenox D.: Rhizomelic Spondylosis, J. Bone & Joint Surg. 24:827, 1942.

This brace permits some extension but no other movement. It is used successfully for correction of dorsal curve and lumbar straightening.

The Callahan spinal brace[9] has essentially the same feature, except that the pads on the sternum and symphysis are connected on the anterior surface of the body by two upright bars of spring steel (Fig. 5). Attached to these bars, around the back, are straps or metal bands, that exert tension on a pad over the spine, pulling or pushing it into hyperextension. This is an efficient brace, affording a means of immobilization in positive hyperextension.

The braces discussed meet the theoretical functional requirements, but, from practical experience, it has been found that some patients cannot stand

Fig. 6. — Author's Functional Hyperextension Brace.

the pressure on the symphysis necessary to stabilize the brace firmly. If moderate pressure is used, slipping occurs. Also, these braces may be uncomfortable in the sitting position, because the altered inclination of the pelvis, involves a shortening of the distance between the symphysis and the sternum. This causes these braces to exert excessive pressure at their extremities. Because of these factors, other types of braces are used, which give the proper degree of fixation and, at the same time, afford sufficient freedom of motion to permit general everyday activities.

9. Thorek, Max: Modern Surgical Technique (Callahan Brace), Philadelphia, J. B. Lippincott Co., 1949.

I prefer a functional hyperextension back brace,[10] constructed on the same basic principle as the Williams brace (Fig. 6). Essentially, this brace consists of a low chair-back brace, to which is added a removable inverted U-shaped frame, which pivots on both the upright bars at an appropriate level. This level varies with the build of the patient. The apex of the U-

Fig. 7. — Cowhorn Brace.

shaped frame expands into a chest plate, padded with sponge rubber, and placed over the upper part of the sternum. The lower free ends contain slots and extend to the level of the posterior part of the pelvic band. Webbing or elastic straps, which are attached firmly to the pelvic band, are drawn through these slots, where they are reversed and fastened to the lower part of the abdominal apron or pad. This arrangement permits hyperextension to be con-

10. von Werssowetz, Odon F.: Functional Hyperextension Back Brace. To be published in J. Bone & Joint Surg.

trolled to the desired degree, and provides adequate stabilization without undue pressure over the symphysis.

Other devices of this type are the so-called Cowhorn and Arnold braces.[11] The principle of these braces is to support the back by pressure on the upper anterior chest, just below the clavicle. The pelvic band in the Cowhorn brace (Fig. 7), is placed at the level of the sacrum. The Arnold brace uses a pelvic section of molded leather. Two back upright bars connect the pelvic part with the upper transverse bar; they are made of spring steel and fit snugly to the contour of the body. The bar clears the axillae and ends anteriorly in circular padded enlargements just beneath the clavicles. In fitting this brace, it is important to make certain that the lumbar and dorsal segments of the spine lie flat against the two uprights. Side motion may be prevented by uprights on each side. The Cowhorn brace differs from the Arnold brace in that the anterior ends of the upper transverse bar come more toward the midline at the sternum and usually are joined by a strap. Because of the mechanical arrangement of these braces, flexion of the spine is impossible.

There are numerous other types of braces used in the attempt to hyperextend the lumbar spine. They are mostly modifications of the Taylor or Knight braces. None of them gives effective functional results because the basic design in these braces is that of a gutter splint. They may be good for immobilizing purposes, but are of little value as functional braces. The main reason for this is that the active kinetic force, essential in a functional brace, is converted into a passive pressure area by the shape and curve of the upright bars. These braces have only one fixed stabilizing point in the pelvic band. From this point, the rest of the support is obtained through the back or side uprights. Because of the poor stabilization of the upper transverse bar, this part of the brace almost invariably pulls away from the body when the patient attempts flexion.

Conclusion and Summary

Probably in no other type of disability is the use of braces abused as much as in painful conditions of the back. As a general rule, in these functional disabilities of the back, a certain amount of muscle imbalance exists. Therefore, the primary treatment objective should be directed toward obtaining a proper balance of muscles controlling and influencing the alignment of the spinal column. It is well to emphasize that muscles will increase in strength only by active use. For this purpose, braces are not only useless but often harmful. Their only justifiable use is to prevent malalignment, produce relaxation of the contracted or spastic muscles, and prevent stretching of the weakened antagonists. In such conditions, braces should be used temporarily and should be coupled with a definite exercise routine for strengthening the weak muscles. They should be discarded as soon as possible.

Basically, the object of functional braces is not to support the body load but to maintain as normal as possible the postural alignment. This should restore the weight bearing stability of the spine and permit the transmission of gravity and weight forces as normally as possible. The brace should preserve the maximal optimal function. The selection of a brace should be based on a careful analysis of the disability and on an accurate calculation of the kind, direction and amount of force required.

All functional spinal braces should be constructed on the three-point pressure system, where two forces are used for stabilization and one for the

11. Arnold, Hubert R.: An Efficient Back Brace, California & West. Med. 46:323, 1937.

kinetic force which attempts to correct the disability. All braces should tend to correct the effect of the deflected weight of the superincumbent load, change to normal the inclination angle of the pelvis, and counteract the abnormal action of spinal muscles. The theoretical object is to select a brace so as to provide a firm and yet elastic support without obstructing the circulation or interfering with any of the vital functions or the movements of the body. In practical experience, this may not be obtainable in all cases, though it is important to provide a brace that will least interfere with normal physiological action.

Some of the most commonly used braces are discussed as to their proper application, their value in treatment and their contraindications.

Discussion

Dr. Robt. W. Boyle (Ft. Thomas, Ky.): The periodic reminder that the medical profession is relatively impotent in treating many of the most common complaints, such as headache, the common cold, sinusitis, backache of unknown etiology, and many others serves as a stimulus to promote more all out effort on the part of the research clinicians to solve these perplexing problems. Dr. von Werssowetz' paper has brought the problem of backache again to our minds.

Of all the conditions the physiatrist meets, one of the most common is backache. The story as unfolded in the paper just presented is as true today as it was 20 or 30 years ago. Not only that, but our ability to cope with the etiology, prophylaxis and treatment are equally troublesome. The symptomatology and signs are well known and have not changed over the years. The treatment has fallen into a cyclic pattern of conservatism, operative interference, conservatism, operative interference and conservatism. However, a study of the results of such treatment shows equally unsuccessful results in the majority of cases. Today each case must be considered individually and what may help one case certainly may lead to disastrous results in another.

To get on with the basic thesis of this paper one must admire the efforts of Dr. von Werssowetz in attacking the problem of selection of braces for backache. His background discussion of the physics of curvature and its correction is a clear and simple explanation of what a brace should do to correct a given deformity. However, as he points out, it is one thing to know what to do, but a far harder task to do it when there are few or no points of stability to act as anchors for the "three point" pressure system.

When one considers that there may be: (a) soft tissues which will yield to pressure; (b) one or many intermediary joints involved between the three pressure points; (c) bony protuberances just under the skin such as the iliac crests, where pressure sores may develop with such a system; (d) pain produced at the sites of the pressure points; and (e) a mental fixation against wearing the brace in its position of maximum benefit; then, if not long before, the physician might have a tendency to give up the ghost and resort to more drastic and permanent measures such as bone grafting, plaster of paris casting, or referral of the patient to an unsuspecting colleague!

Another aspect of the problem of back bracing is the dependency reaction seen so often in industrial, pension, and compensation cases. Here the patient claims such marked benefits from the use of the brace that he will not give it up long after he no longer has use for it. As a matter of fact, the dependent attitude may lead to sufficient muscular atrophy that the patient finally must either go through a rigid course in muscle retraining and strengthening or continue to wear the brace as a physiologic crutch.

Dr. von Werssowetz is cognizant of this latter possibility, for he points out that the brace must be an adjunct to other good physical medicine procedures, including a goodly amount of strength building exercise, and that the patient must be weaned from the brace as soon as possible.

The fact that there are so many different types and styles of back braces reinforces the adage that each case must be individualized and that without knowing the cause of the backache there can be no universal back brace.

It is obvious that this discussion has skirted around the edges of Dr. von Werssowetz' paper touching only here and there on points of interest to the discussor. It is also equally obvious that the discussor is woefully ignorant of certain orthopedic appliances, when referred to by the names of the originator of the appliances. It is wonderful that we can recognize an outstanding physician by his contribution to his own field of endeavor. It would be equally wonderful if the name of the appliance described what that appliance was or what it attempted to do.

"The author wishes to express his appreciation and thanks to Mr. Wallace Sladek, Chief of the Orthopedic Brace Shop, Thayer VA Hospital, Nashville, Tennessee, who constructed all of the braces pictured, except those in Figures 5 and 7. These were constructed by Mr. Carl G. Albright, Supervisor, Orthopedic Brace Shop, Lawson VA Hospital, Chamblee, Georgia, to whom the author is greatly indebted."

A PORTABLE ELECTRONIC PULSE DETECTOR *

HENRY FLECK, M.D.

NEW YORK, N. Y.

Detection of the arterial pulse in peripheral vascular disease, depends largely upon the sensitivity of the cutaneous receptors of the observer's fingers. Since presence or absence of the pulse might influence a decision in favor of surgical or other intervention, an instrument was devised, the sensitivity of which goes beyond that of human perception, and which permits direct observation.

The problem to be solved was that of transforming a mechanical impulse into an electrical impulse, and to amplify the latter in such a way as to permit registration on a sensitive meter or the electrocardiograph.

Figure 1.

The apparatus consists of two parts: The pick-up and the amplifier.

(1) The *pick-up* (Fig. 1 and 2) makes use of a mechano-electronic transducer RCA 5734, as used by Curtis and Nickerson.[1] This is encased in a

* From the Department of Physical Medicine, Bronx Hospital.

1. Curtis, H. J., and Nickerson, J. L.: Application of the Transducer Tube to the Recording of the Peripheral Pulse, Proc. Soc. Exp. Biol. & Med. 70:383, 1949.

metal holder, one-half of which is cut away at one end, and provided with a hole. Through this hole, slightly below the surface of the holder, projects a plastic knob at the end of a metal stylus, which is soldered at right angles to the plate shaft of the tube.

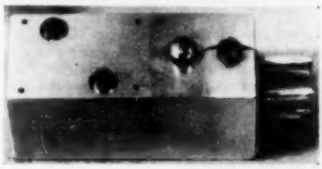


Figure 2.

Any movement of the plastic knob moves the plate in the tube, and thereby changes the electro-static field between it and the cathode. This change, which increases or decreases the plate current, is amplified.

(2) The *amplifier* (Fig. 3) consists of one stage of amplification and a balanced bridge circuit, as indicated in the diagram. Its sensitivity can be varied by means of both input resistors.

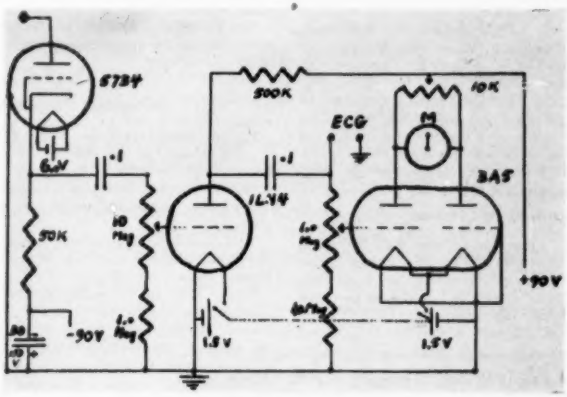


Figure 3.

The pick-up can be moved about until the pulse is found, and then may be strapped to the region where the pulse is to be recorded. The pulse can be observed on the zero center microammeter (M) or the first stage of amplification can be coupled to the electrocardiograph.

The device is portable and its power requirement is small.

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least three weeks before the date of meeting.

New Instructors at Northwestern University Medical School Course in Physical Therapy

Following the retirement of Miss Gertrude Beard as Technical Director of the Course in Physical Therapy at Northwestern University Medical School, after twenty-five years of service, and the resignation of Miss Dorothy Dean, who served as Instructor and Associate in Physical Medicine from 1942-1952, Dr. Stafford L. Osborne, Professor Emeritus and Acting Chairman of the Department of Physical Medicine has announced the following new appointments to the staff:

Elizabeth Wood, former instructor, has been made Technical Director. Miss Nan Dickson of Chicago, formerly Chief Physical Therapist at St. Lukes Hospital and staff Physical Therapist at Wesley Memorial Hospital, joined the staff as full-time instructor on August 1, 1952, and Miss Dorothy Gorski, also of Chicago and from the St. Lukes Hospital Physical Therapy Staff, started as full time instructor on September 15, 1952.

Seminar at Tulane

A seminar on "Low Back Pain" will be given on February 27-28, 1953, at the Division of Graduate Medicine, Tulane University of Louisiana School of Medicine. Inquiries should be directed to Dr. Jack Wickstrom, Chairman, 1430 Tulane Ave., New Orleans 12, La.

TV Films on Physical Therapy

Film sequences were made at the Institute of Physical Medicine and Rehabilitation, New York University-Bellevue Medical Center, to be used in a series of TV programs this fall.

New Jersey Society Meets

At the October meeting of the New Jersey Society of Physical Medicine, Dr. Herman Rudolph spoke on "Physical Medicine and Rehabilitation of Hemiplegia at Home."

Clinics on Cerebral Palsy

Dr. Winthrop M. Phelps will conduct consultation clinics on cerebral palsy on Dec. 4 and 18 at 1767 Massachusetts Ave., N. W., Washington, D.C. The clinics will last from 10 A. M. to 3 P. M.

Personals

Dr. **Robert M. Stecher,** Cleveland, Ohio, is a nominee for Secretary-Treasurer of the newly formed organization known as "Friends of the Armed Forces Medical Library."

Dr. **Howard A. Rusk** of New York City was one of the speakers at the annual meeting of the Association of Military Surgeons held at the Statler Hotel, Washington, D. C., November 17-19, 1952.

Dr. **Edward Gordon** is author of four manuals on multiple sclerosis issued by the National Multiple Sclerosis Society.

Dr. **Ralph E. Worden** is the new director of a rehabilitation center recently established at Ohio State University.

Accepted Apparatus

Kidde Tubal Insufflator, Office Model No. 605700. — Manufactured by Kidde Manufacturing Co., Inc., 35 Farrand St., Bloomfield, N. J., apparatus is for controlled injection of carbon dioxide into the uterine tubes for diagnostic and therapeutic purposes.

The Council on Physical Medicine and Rehabilitation voted to include the device in its accepted list.

Vaso-Pneumatic. — Manufactured by Poor & Logan Manufacturing Company, 7319 Varna Ave., North Hollywood, Calif., apparatus is designed for use in the treatment of peripheral vascular disease. The Council on Physical Medicine and Rehabilitation secured evidence to indicate that the device was well designed and was useful in the treatment of certain types of peripheral vascular disease.

Gynogauge (Weisman). — Manufactured by Goodman-Kleiner Co., Inc., 5 E. 17th St., New York 3, N. Y., device is used for injecting carbon dioxide at controlled pressure into the uterine tubes. Evidence was obtained by the Council on Physical Medicine and Rehabilitation that the apparatus is well made and performs satisfactorily under standard office conditions.

Stafford L. Osborne

It is with regret that we announce the death on October 24 of Stafford L. Osborne, Ph.D. Dr. Osborne was a recipient of the Gold Key and has been closely associated with the Congress for many years. His death resulted from pneumonia.

ARCHIVES of PHYSICAL MEDICINE
OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL MEDICINE

.·. EDITORIALS .·.

SIGNIFICANCE OF THE COULTER MEMORIAL LECTURE

The lead article in this issue should prove of exceptional interest to the readers of the ARCHIVES. It is the Second John Stanley Coulter Memorial Lecture, delivered before the 30th Annual Session of the American Congress of Physical Medicine and Rehabilitation by Dr. Frank H. Krusen, for years closely associated with Dr. Coulter. The lecture honoring John Stanley Coulter revives in our memories his outstanding accomplishments. Through tireless and indefatigable labors, he did much towards the establishing of physical medicine on a sound scientific basis and bringing about its acceptance as a recognized medical specialty.

The present lecture is more than a tribute to a great physiatrist. It is a contribution to better understanding among physicians of their international responsibility. Dr. Krusen devoted his address to a delightful and informative account of the proceedings of the International Congress of Physical Medicine and Rehabilitation held in England last July. The meeting, conducted with a dignity traditionally British, was conspicuous for the excellence of the scientific contributions and discussions. It also exemplified the unfailing courtesy and abundant hospitality of the English hosts. The formation of such an International Congress was dear to the heart of Dr. Coulter. What satisfaction he would have experienced, could he have lived to see the fulfillment of one of his dreams!

With unrest throughout the world straining the relationships of nations almost to the breaking point, such a scientific gathering takes on added significance. Science knows no barriers, neither geographic, racial nor political. Mutual interchange of knowledge continues to be the most potent medium for maintaining good will among the peoples of the earth. Even between the nations of the West and those isolated behind the "Iron Curtain," the common bond of scientific thought remains a still effective means of contact, albeit a tenuous one. It is heartening to all who seek peaceful understanding of the difficulties and problems that beset nations that plans have been made for additional countries to sponsor future International Congresses of Physical Medicine and Rehabilitation.

EDUCATIONAL PROBLEMS OF PHYSICAL THERAPY

The demand for qualified men and women properly trained in the professional and technical aspects of physical medicine and rehabilitation continues unabated. Governmental and state agencies as well as privately controlled civilian institutions suffer alike from the shortage that exists in personnel experienced in this field.

The lack of physicians competent to direct Departments of Physical Med-

icine and to train others in this specialty has been the subject of editorial comment in this journal on several occasions. In this connection mention should be made of a plan recently developed by the National Foundation for Infantile Paralysis whereby undergraduate summer internships in physical medicine were made available to third year medical students. Of necessity only a small number of students were able to take advantage of this opportunity. The results obtained last summer, the first during which this arrangement was operating, have been most encouraging. Those who observed the work and reaction of the participating medical students are in agreement that this educational innovation has done much to arouse in them greater interest in and better understanding of physical medicine and its indispensable role in rehabilitation. Future recruitment of physiatrists depends primarily upon the creation of enthusiasm for this specialty during the period of undergraduate training. Thanks are due the National Foundation for its pioneer effort.

The interest of the physiatrists cannot be restricted to their professional colleagues in physical medicine. They must be equally concerned with the enrollment and training of non-medical personnel needed to fill the ranks of the physical therapists. The position of those who specialize in physical medicine is unique in that they depend in no small degree upon the assistance of qualified physical therapists to carry out the treatments which they prescribe. The lack of expert technical help undeniably impairs efficiency in patient management. Therefore, from the standpoint of professional efficiency alone the need for physical therapists is obvious. In this respect a rough analogy may be drawn between physical therapists and x-ray technicians. The roentgenologist, like the physiatrist, relies upon efficient technical assistance. There is, however, an important difference between the duties of x-ray technicians and physical therapists. The latter are required not only to carry out technical procedures but frequently are called upon to assist in the education and training of patients. This is notably true in the rehabilitation of those suffering from poliomyelitis, cerebral palsy, hemiplegia, paraplegia and amputations, to mention only some of the commonly met conditions. Consequently, physical therapists play a definite role in actual treatment. Furthermore, therapists often are responsible for carrying out prescribed treatments during the intervals between the doctor's visits. In view of this situation physiatrists must be concerned not alone with the much needed numerical increase in physiatrists, but, also, with maintenance of the educational standards in our schools for physical therapists. These standards have been brought to their present high level only after years of thoughtful effort. The need for physical therapists is not a valid reason for lowering the educational prerequisites for admission to our schools for physical therapy nor for weakening their basic curricula. The best interests of patients, physicians and physical therapists are safeguarded by insistence upon an adequate general education as a preliminary to thorough technical training of those who enter physical therapy.

Physicians who hold positions as directors or medical directors in many of the Schools for Physical Therapists have an unescapable responsibility for the training programs of their schools. They in particular should acquaint themselves with an excellent discussion carried on at the special meeting of the Physical Therapy Directors held during the American Physical Therapy Association Conference last summer. At that time, a thought provoking report on some of the Problems of Physical Therapy Schools was presented by Miss Catherine Worthingham, Director of Professional Education of the National Foundation for Infantile Paralysis.

Miss Worthingham stresses the dangers inherent in a two year educational prerequisite for admission to a one year course in physical therapy. She cites convincing figures to show the present definite trend toward the degree course. In 1945 only seven out of thirty-two physical therapy schools, eight of which were conducted by the Army, offered degree courses. In 1952, twenty out of twenty-eight approved civilian schools are conducting courses leading to a degree.

Miss Worthingham shares the view that even the great need for physical therapists does not justify widespread advocacy of the two year college prerequisites for a certificate course in physical therapy, especially since at present only three schools admit students on that basis. Nor does she believe that elevation of educational standards has decreased the numbers graduating from our schools. In support of this contention she points out that from sixteen approved schools in 1941 there were 238 graduates and the total number of registered physical therapists was 1,604. After the war, in 1947, there were 383 graduates from twenty-three schools. The total number of physical therapists had risen to 4,684. At the end of a ten year period (1951) twenty-eight schools graduated 585 students and the physical therapists numbered 6,754. Thus, in a decade, the number of approved schools had almost doubled; the graduates per year had more than doubled and there were four times as many physical therapists available. We agree with her comment that "this is a good record for any profession."

Further expansion of existing teaching programs and the initiation of adequate new programs in physical therapy is imperative. This is so because it is estimated that by 1958 at least 7,500 more physical therapists will be needed. To meet this demand 10,700 will have to be educated by that date. Since the present maximum capacity of the approved schools is approximately 777, to carry out this expanded educational program involves doubling that number of graduates. Such an undertaking presents many difficult problems.

As the concept of total rehabilitation of the patient continues to gain acceptance among physicians, particularly general practitioners, the future demand for qualified physical and occupational therapists will increase. Therefore, not only physiatrists but the entire medical profession must help meet this situation and become concerned with stimulating recruitment in and the educational advancement of these technical groups.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation.

HOW TO SLEEP WITHOUT PILLS. By *Dr. David F. Tracy.* Introduction by *T. S. Welton,* M.D. Second Edition. Cloth. Price, $1.00. Pp. 62, with illustrations. Sterling Publishing Co., Inc., 141 E. 44th St., New York 17, 1951.

The qualifications of the author of this book are not made clear on the title page, which fails to state his address and institutional connections. The text itself offers, mixed with a large proportion of the plausible and the undeniable, enough dubious material about hypnotism and auto-suggestion to make the cautious reader wonder just what is behind this book. The author states (page 10) that a patient will awaken more rested after an hour of hypnotic sleep than after hours of usual restless sleep, and (page 56) that a hypnotist can make one remember things that happened when one was three years old. His opinion of current science is revealed by a reference to "scientific and superstitious mumbo jumbo" on page 6; he seems not to realize that "scientific mumbo jumbo" is a contradiction in terms that will be resented by everyone earnestly desiring the advancement of science. This book is not recommended.

ADVANCES IN ENZYMOLOGY AND RELATED SUBJECTS OF BIOCHEMISTRY. Volume XII. Edited by *F. F. Nord.* Cloth. Price, $9.75. Pp. 570, with illustrations. Interscience Publishers, Inc., 250 Fifth Ave., New York 1; 2a Southampton Row, London, W.C.1, 1951.

Editor Nord of Fordham University has presented an authoritative work which has been written by twelve of the ablest men in this discipline. Each writes a chapter on the subject in which he is an acknowledged master. While this volume will have its greatest appeal to the biochemist and physiologist, it will have a limited appeal only to those physicians who have an interest in this subject.

Robert Hill of Cambridge, England, writes a chapter on oxidoreduction in chloroplasts which is concerned with the biochemical knowledge we have at the moment of the nature of the green plastids of plants. Utter and Wood of Western Reserve have written on the fixation of carbon dioxide. Their discussion is limited to the mechanisms of synthesis of the carbon skeletons of the various compounds from carbon dioxide. The subject of enzyme-subtrate compounds is written by Britton Chance of Philadelphia, who discusses the nature and properties of these compounds. Emil Smith of Salt Lake City writes a chapter on the specificity of certain peptidases. Nachmansohn and Wilson of New York write on the subject of enzymic hydrolysis and synthesis of acetylcholine. Their review is limited to the presentation and analysis of a few important features and of some recent advances of interest for the enzymologist. Kurt Meyer of Geneva, Switzerland, writes a chapter on the present status of starch chemistry which is concerned only with natural starch and its constituents. Peter Bernfeld of Tufts writes a chapter on enzymes of starch degradation and synthesis and states that this depends more than most other enzymic reactions on the peculiarities of the substrate. Biological methylation is the subject of a chapter by Frederick Challenger of Leeds, England. Charles Little writes on the reactions of borate with substances of biological interest. Each of the nine chapters is closed with an extensive and valuable list of references for more detailed study. There is also an author and adequate subject index. In addition there are included both an author and subject cumulative index for volumes one to twelve.

This volume is highly recommended to the biochemist or the physician who has a particular interest in this field.

THE FACTS OF LIFE FROM BIRTH TO DEATH. By *Louis I. Dublin,* Ph.D., Second Vice-President and Statistician, Metropolitan Life Insurance Company. In Collaboration with *Mortimer Spiegelman,* F.S.A., Assistant Statistician Metropolitan Life Insurance Company. Cloth. Price, $4.95. Pp. 461. The Macmillan Company, 60 Fifth Avenue, New York 11, 1951.

Dr. Dublin's aim is to convey succinct information on problems of human health and disease. This he is well equipped to do. The material is arranged in the form of question and answer. The questions are well chosen and the answers sober, factual, and discreetly evaluative; the information is given at the level of the intelligent lay reader; sources of more detailed information are noted. The arrangement is not conducive to consecutive reading, but this is proper in a book intended for reference.

It will be useful in any doctor's office and, in fact, in the office of anyone who deals with some phase of public health; it will probably fascinate those laymen who have an overweening curiosity about disease. The title embodies the only distinguishable witticism.

TUMORS OF THE SKIN: BENIGN AND MALIGNANT. By *Joseph Jordan Eller*, B.S., M.D., Director of Department of Dermatology, New York City Hospital, New York, and *William Douglas Eller*, M.D., Assistant in Dermatology and Syphilology, University Hospital, New York-Bellevue Medical Center, New York. Second Edition. Cloth. Price, $15.00. Pp. 697, with 553 illustrations. Lea & Febiger, 600 S. Washington Sq., Philadelphia 6, 1951.

In this volume by Eller and Eller (Lea & Febiger, Philadelphia), the authors have divided the subject matter into three major sections: general considerations, benign tumors, and malignant tumors. Under the second section, some 48 benign growths, 5 of infectious origin and 19 instances of precancerous dermatoses are described and classified clinically and histologically. Methods of treatment that offer the best prognosis and cosmetic results are presented in detail. The section on malignant tumors is unusual in that the treatment of carcinomas of various types in special locations is diagrammed and the practical application of different methods of therapy is described for each lesion. A chapter concerns the management of malignant melanoma. Other malignant lesions discussed include thirteen sarcomas of different types and origin, and seven lymphomas, including the leukemias. Chapters are devoted to cutaneous surgery and plastic repair of the skin tumors and extensive discussion of the application of radiotherapy includes a number of dosage tables and diagrams. The text has been expanded and brought up-to-date; several new disease entities have been added. There is an extensive bibliography at the end of each chapter and the subject matter is well indexed. This book will prove a useful reference for dermatologists, radiologists, surgeons, and others interested in tumors of the skin.

DISEASES OF THE NERVOUS SYSTEM. By *W. Russell Brain*, D.M., F.R.C.P., Physician to London Hospital and to Maida Vale Hospital for Nervous Diseases. London. Fourth Edition Cloth. Price, $8.50. Pp. 1002, with 85 illustrations. Oxford University Press, 114 Fifth Ave., New York 11; Amen House, Warwick Sq., London, E.C.4, 1951.

This is a fourth edition of this text since 1933. The most notable additions since the third edition are discussions of the use of new drugs for tuberculous meningitis, subacute combined degeneration, epilepsy and Parkinson's disease.

This is an excellent text for students and for reference use for the practicing physician. Anatomical relationships, and aspects of functional neurophysiology are incorporated into the clear clinical descriptions of neurological syndromes to help the clinician in diagnosis. Pathology is briefly discussed, but references are included. Prognosis is described in general terms together with specific treatment when such is known. The use of physical medicine and rehabilitation procedures is not included in sufficient detail to help the physiatrist.

BIOLOGICAL EFFECTS OF EXTERNAL BETA RADIATION. Edited by *Raymond E. Zirkle*, Professor of Radiobiology, Institute of Radiobiology and Biophysics, University of Chicago, Chicago. National Nuclear Energy Series: Manhattan Project Technical Section. Division IV: Plutonium Project Record, Volume 22 E. Cloth. Price, $3.25. Pp. 242, with illustrations. McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York 18; Aldwych House, Aldwych, London, W.C.2, 1951.

Biological effects of external beta radiation is one volume of a series giving a record of the research work done by the Manhattan Project and the Atomic Energy Commission. The declassified portion of the National Nuclear Energy Series, when completed, is expected to consist of some sixty volumes which will be grouped into eight divisions. A Project Editorial Advisory Board was designated to prepare a unified account of Atomic Energy Project work. For reasons of national security there was considerable duplication of effort. The Editorial Board has attempted to reduce duplication insofar as possible and to eliminate discrepancies in factual data.

This volume is a technical account of information collected while developing methods for producing plutonium. These papers represent selections from the great mass of current reports, made on the basis of their value to basic science and technology. The work was part of an intensive radiobiological program carried out during World War II at Clinton Laboratories, Oak Ridge, Tennessee, under the supervision of Dr. Howard J. Curtis.

Doctor Zirkle has had a most difficult task as editor of this volume. Most of the writing had to be done hastily because the authors were returning to their pre-war positions. The shortage of manpower made it impossible to edit manuscripts as carefully as desirable. Nevertheless, Doctor Zirkle deserves great credit for a difficult task well done. Contributing authors were Elizabeth Anderson Barnes, K. K. Barnes, Purdue University; P. S. Henshaw, Public Health Service, Washington, D. C.; J. R. Raper, University of Chicago; E. F. Riley, Jr., State University of Iowa; R. S. Snider, Northwestern University Medical School; J. E. Wirth, Pasadena, California; and R. E. Zirkle, University of Chicago.

There are sixteen chapters. Chapter one gives the sources and techniques that were developed to administer external beta-ray exposures to various biological materials. The experiments consisted of a study of: 1, acute total-surface irradiation of mice, rats, guinea pigs, and rabbits; 2, daily low-dose exposure of mice and rats; and 3, irradiation of restricted areas of rabbit and man. Both early and delayed effects were studied while lethal action was studied intensively. The lesions are well illustrated by photographs, many of them in color. Each chapter opens with an excellent abstract which is most helpful. Each chapter is closed with a well chosen list of references for further study. The work is well presented in

clear and concise language. This is a most useful volume and is undoubtedly but the starting point to new reaches of knowledge.

CURRENT THERAPY, 1952. LATEST APPROVED METHODS OF TREATMENT FOR THE PRACTICING PHYSICIAN. Editor, *Howard F. Conn*, M.D. Consulting Editors, *M. Edward Davis, Vincent J. Derbes, Garfield G. Duncan, Hugh J. Jewett, William J. Kerr, Perrin H. Long, H. Houston Merritt, Paul A. O'Leary, Walter L. Palmer, Hobart A. Reimann, Cyrus C. Sturgis*, and *Robert H. Williams*. Cloth. Price, $11.00. Pp. 849. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1952.

This is an amazing compilation of authoritative opinion on treatment by recognized specialists. Correct diagnosis is assumed and the presentations are confined to well condensed, often outlined discussions of necessary and medicinal, dietary and nursing orders. The most detailed consideration is in regard to administration of drugs. In case of controversial methods of treatment, alternative opinions are given without editorial comment.

This would appear to be an extraordinarily valuable desk reference for the busy general practitioner and for medical students and hospital resident staffs.

Surgical, psychiatric and physical medicine and rehabilitation procedures are essentially omitted except for brief reference.

A SYNOPSIS OF NEUROLOGY. By *W. F. Tassington Tatlow*, M.D., M.R.C.P. (Lond.), Medical Registrar, Maida Vale Hospital for Nervous Diseases, London; *J. Amor Ardis*, M.D., Ch.B., D.P.M. (Brist. & Lond.), Senior Registrar in Psychiatry, Aberdeen General and Mental Hospitals; and *J. A. F. Bickford*, M.R.C.S., L.R.C.P., D.P.M. (Brist.), Senior Registrar in Psychiatry, Maryfield Hospital, Dundee, and Dundee Mental Hospital, Gowrie House. Cloth. Price, $6.50. The Williams & Wilkins Company, Mt. Royal and Guilford Avenues, Baltimore 2, 1952.

For some reason Neurology has a reputation of being a difficult subject. It is possible that this book will do much to change that impression, for it is ideal for student use. There is a wealth of anatomical, physiological and clinical data presented, with a minimum of words and a number of clear diagrams. The outstanding feature of the text is its style of presentation in outline form. This allows for a maximum of detailed information with a minimum of reading; in fact, it represents in all likelihood the ideal manner of answering written specialty examination questions and consequently should appeal greatly to all studying for examinations. The reviewer's excellent impression of the book is in part due to the contrasting type, enabling the reader at a glance to determine the essential content of each page. In a sense this is a manner of spoon-feeding the student as the authors have predigested the subject under discussion and skilfully abstracted the essential kernels for consumption. This will undoubtedly be a very popular text for students of neurology; it will also be a valuable addition to the library of the specialist in the field and to all practitioners as a handy reference.

THE PHYSICIAN AS MAN OF LETTERS, SCIENCE AND ACTION. By *Thomas Kirkpatrick Monro*, M.A., M.D., LL.D., Emeritus Regius Professor of Practice of Medicine in the University of Glasgow, Honorary Fellow of the Royal Faculty of Physicians and Surgeons, Glasgow; Honorary Member of the Royal Medico-Chirurgical Society of Glasgow; Honorary Member of the Association of Physicians of Great Britain and Ireland. Second edition. Cloth. Price, $4.50. Pp. 259. The Williams & Wilkins Co., Mt. Royal and Guilford Aves., Baltimore 2, 1951.

This book consists of 25 chapters describing the lives of physicians who attracted attention for their activities in such non-medical fields as literature, science, exploration, government and philanthropy. Each of the persons mentioned is represented by a succint biography, and the result is a collection of facts at once illuminating and inspiring. The last chapter, "Some Students of Medicine Who Never Qualified," gives amusing facts about a remarkably long list of famous men. The author is to be commended for avoiding the breathless, exaggerated style by which occasional modern authors try to enliven medical subjects for popular consumption; his wealth of objective information speaks for itself. It is hard to imagine any type of reader who would not find something in this book to enjoy.

ELEMENTARY MEDICAL STATISTICS. THE PRINCIPLES OF QUANTITATIVE MEDICINE. By *Donald Mainland*, M.B., Ch.B., D.Sc., F.R.S.E., F.R.S.C. Professor of Medical Statistics, Division of Medical Statistics, the Department of Preventive Medicine, New York University College of Medicine. Leatherette binding. Price, $5.00. Pp. 327 with illustrations. W. B. Saunders Company, West Washington Square, Philadelphia 5, 1952.

Shorter, and much less formidable in appearance, than the classic "Medical Biometry and Statistics," by Raymond Pearl, the present book by Mainland has many of the best qualities of the older work. These include especially a warm directness of style and perhaps even a keener understanding of the interests of a medical student. The introduction of the theory of probability in many textbooks by references to penny-tossing has become conventional and ineffective; instead, from the first page on, the present author refers to medical experience and publications. This will be appreciated by readers who seek an understanding of underlying principles. It is not a complete treatise on statistical theory; neither is it a cook-book to be followed in working out technical procedures like the calculation of a correlation coefficient. It can be recommended to instructors as an authoritative and interesting basis on which to build up a brief course on statistics for first- or second-year medical students.

PHYSICAL MEDICINE ABSTRACTS

Parkinsonism. Hugh G. Garland.

Brit. M. J. 1:40 (Jan. 19) 1952.

Parkinsonism is an irreversible process, and no patient has ever been cured. A small proportion of postencephalitic cases become stationary for very long periods, and perhaps indefinitely, but all other forms of Parkinsonism are inevitably progressive sooner or later, though often with stationary phases.

Physical therapy probably is as important as medicinal treatment. The essential part of physical therapy is vigorous active exercises employed for all limbs, and in the very advanced Parkinsonian daily passive movements of all joints are essential. Hot baths often will relieve the disability in the joints and to some extent the general stiffness. Massage, all forms of electricity, and all emanations have no particular value in the disease.

The Painful Shoulder. R. J. W. Withers.

Brit. M. J. 1:40 (Jan. 5) 1952.

For rupture of the supraspinatus tendon, conservative measures are adopted in all cases, and the arm is put at complete rest either in an abduction shoulder splint or else with the arm at the side in a sling or bandaged to the chest wall.

If there is return of some shoulder elevation within four to six weeks conservative measures can be continued and physical therapy and exercises will complete the return of shoulder function. When no recovery of elevation has occurred in six weeks, operation to repair the ruptured supraspinatus is advised. The aftercare consists of rest for the shoulder with the arm in a comfortable position — the author does not now use an abduction splint — until pain and joint irritability have subsided; thereafter active exercises aided by hot packs and assisted movements from the physical therapist are used.

When a painful arc of movement during mid-elevation of the shoulder has developed, conservative measures are adopted at first; these consist in teaching the patient how to avoid if possible those movements which cause pain. Repeated injections of procaine into the subdeltoid bursa also help, but it is difficult to see how physical therapy in any form can affect lasting change. About five out of every six cases eventually clear up whether "treated" or left to their own devices. The remainder should be treated surgically.

Patients with "frozen" shoulder should be divided into the subgroups of (1) irritative lesions, where there is a full range of passive movements, and (2) adhesive lesions, where movement is restricted though it can be freed by manipulation.

Treatment of irritative lesions is primarily by rest, support of the arm in a sling being easiest for the patient. There are no real advantages in keeping the arm in an abduction shoulder splint; instead, this often increases pain. Heat in one of its various forms usually is ordered, but in a considerable number of cases this treatment may increase the pain and have to be stopped. If complete rest is given to the shoulder, the severe pain gradually subsides in four to six weeks, and as soon as this occurs gentle exercises for the shoulder should be encouraged, aided if need be by massage. Exercises are best done with the patient in supine position. In the average case return of function may be expected in three to four months, though it will not be full for eight months or even a year in the worst cases.

In many cases replacement fibrosis occurs after the acute irritative stage has passed. At this stage pain is much less severe and usually occurs only on attempted movement. While the shoulder is still "frozen," there is a little movement at the shoulder-joint, so that, along with the scapular glide, the arm usually can be elevated by the patient to about a right-angle. At this stage manipulation of the shoulder under anesthesia is called for, when full movement usually can be obtained with palpable or even audible "snaps" which are due to the breaking down of adhesions. The manipulation must be carried out very gently, and, as a first measure, should be through full lateral rotation only. Often one manipulation is enough to free the joint, and it is usually found that after manipulation physical therapy is a real help in hastening full recovery.

Neurovascular Syndromes of the Shoulder Girdle. F. Stanley Morest.

J. Kansas M. Soc. 53:57 (Feb.) 1952.

There are four main types of anatomic derangement of the shoulder girdle which may be responsible for neurovascular syndromes involving the upper extremities; namely, the cervical rib, scalenus anticus costoclavicular and hyperabduction syndromes. After correct diagnosis, treatment often brings dramatic relief. Keeping the arm out of faulty position often is sufficient to relieve the pain. In analyzing the activities of a patient over a 24-hour period, any faulty position assumed during work, play or sleep, as the particular case illustrates, must be corrected. Frequently, as in mechanics working with arms overhead, it will be necessary for them to change jobs, or omit a portion of the work responsible for using the arm in a faulty position. A change in sleeping position often is necessary. Supplemental measures are designed to increase the angle formed between the clavicle and first thoracic rib

by exercises designed to strengthen the so-called "elevator muscles" of the shoulder girdle, like the trapezius and elevator scapulae. Wright has outlined helpful exercises, such as shrugging of the shoulders forward and backward while holding a five-pound weight in each hand. Reaching exercises are carried out by the patient hanging from a horizontal bar or by extending arm upwards overhead and placing a mark on a door or wall. The patient tries to exceed his mark by one-fourth inch daily. These patients must be warned to begin with only three times for each exercise and to progress by one more time daily, thus avoiding induction of any muscle strain. Likewise, increasing gradually the amount of the weight held in each hand, it will be possible to go from 5 to 20 pounds in several weeks, if necessary. If the patient is guilty of faulty body posture as well, it also must be corrected.

Control of Cold in Industry. A. K. Hill.

Brit. J. Phys. Med. **15**:37 (Feb.) 1952.

A virus is now accepted as the essential cause of what is called the common cold; but little is yet known of the properties of the virus itself, or of the factors which are related to human resistance or susceptibility to infection by the virus. It is Hill's opinion that the most hopeful method of controlling the common cold is by general hygienic measures, supplemented in some cases by physical or chemical techniques. There are, however, several prophylactic measures which have been used extensively, but with what success is still being argued. Special measures include ultraviolet irradiation, vaccines and vitamins. Exposure to ultraviolet light, in short repeated courses or regularly during the winter months, has many advocates and is much used in industry. Of four methods of prophylaxis tried, this was the only one which reduced both the severity and the number of colds in a large factory. Such exposure may be of value in raising the level of general physical fitness, but the reports on its value in preventing colds are very conflicting. The number of victims of colds who are sun-tanned and physically fit after a recent holiday has greatly reduced the faith which Hill did have in the prophylactic value of ultraviolet light. It is his impression that no purely prophylactic measure is of proved value when applied generally to large numbers of persons, but that in selected cases, one or the other method may be successful.

Rehabilitation Techniques with Braces and Crutches: IV. Methods of Falling and of Getting Down and Up from the Floor. Morton Hoberman, and Erbert F. Cicenia.

Am. J. Phys. Med. **31**:21 (Feb.) 1952.

Most of us have an inherent fear of falling. Practically all disabled persons have a fear of loss of support and falling. Although we cannot expect to conquer these fears completely, we can do much to promote a calm self-assurance and to quicken our presence of mind in situations where the inherent fears come into play. Physically disabled persons can be taught the "know how" through adherence to simple safety measures and by early instruction in the proper way to ease a fall. The cardinal safety measure is a progressive approach from the simple to the more difficult. If the preliminary fundamentals are well learned, the danger of falling will be minimized to only unpredictable hazards encountered during the course of a normal day. Instruction in falling should be begun early in the individual's rehabilitation program, even before braces and crutches are used. Falling always should be practiced on well-padded surfaces, such as a soft mat, mattress, or if outdoors, on a soft heavily-grassed spot. This installment of rehabilitation techniques dealing with braces and crutches outlines methods of falling and of getting down and up from the floor. Several methods are described and reinforced by excellent illustrations. The more techniques achieved, the greater the ability to maneuver the body under all circumstances. The methods described in this article are mainly for patients with complete or partial paralysis of the lower trunk and both lower extremities. However, with some ingenuity, these methods can be modified for those patients with more involved residual physical disabilities.

Influence of Procaine Infusions on the Temperature of Muscle and Skin of Poliomyelitis Patients. Steven M. Horvath; Harold N. Taylor; Attie Y. Werner, and W. D. Paul.

Am. J. Phys. Med. **31**:14 (Feb.) 1952.

Forty patients with acute poliomyelitis were given intravenous infusions of procaine. Peripheral vasodilatation as indicated by elevated toe temperatures was observed in only 17.7 per cent of these patients. The mean temperature elevation in noninvolved and involved muscles was approximately 0.2 C. This increase cannot be considered to indicate an augmented blood flow through the muscles. The temperature of the gastrocnemius muscle of the involved extremity was lower than in the noninvolved extremity and appeared to be, at least, casually related to the degree of involvement.

After-Care for the Poliomyelitis Patient. Morton Hoberman.

New York State J. Med. **52**:323 (Feb. 1) 1952.

After-care for the poliomyelitis patient following hospital discharge is an aspect of total care which has not received sufficient emphasis. Perhaps some of the indifference to this phase of the disease is due to a lack of appreciation of what adequate after-care entails. It may also be related to an oft-repeated statement attributed to Bennett, to the effect that nearly all poliomyelitis patients exhibit 80 per cent of their eventual maximal return of muscle strength within nine months after onset, and the impression that after eighteen months no further increase in muscle strength can be expected. Another possible reason results from a concept that, after discharge from the hospital, only functional activity is of importance and is

sufficient to bring the affected musculature to its greatest strength and endurance. After-care for the poliomyelitis patient is a long-term program, whether the patient is mildly, moderate, or severely involved. As might be expected, the moderately and severely involved poliomyelitis patients usually receive more thorough after-care for longer periods than do the so-called non-paralytic and mildly involved patients. This is unfortunate, since it cannot be emphasized too strongly or too often that deformities, contractures, and other undesirable residuals can and do, in fact, occur in any phase or period of the disease as well as in any type of patient. Also, the vastly superior numbers of the latter type of patients (non-paralytic or mildly involved) make it imperative that they be followed carefully for sufficiently long periods after discharge from the hospital.

Chronic Rheumatoid Arthritis. Euclid M. Smith.

South M. J. **44**:925 (Oct.) 1951.

The therapeutic approach to this complex syndrome is extremely difficult and should be undertaken only after a thorough study of each individual patient. After sufficient data have been assembled and evaluated, a plan of therapy should be developed which will meet the individual requirements of the patient and maintain the individual in the best possible state of physical and mental fitness until complete rehabilitation has been attained. Adequate nutrition is essential. Physical and mental rest, rest balanced with exercise, are needed. The relief of pain and the prevention and correction of deformities are all important objectives of therapy. To attain these objectives there is available a goodly number of reliable therapeutic agents comparatively simple in their application, and in the hands of an experienced therapist they are of proven value. Drugs for relief of pain, improved nutrition, functional management, psychosomatic methods, orthopedic treatment, climate and spa therapy, and physical medicine, all are reliable therapeutic measures, and when properly applied are most effective in relieving symptoms and in controlling the clinical course of the disease. Even the most enthusiastic interpretation of all recorded observations in this field must lead to the conclusion that there is no specific therapy for rheumatoid arthritis.

The Restoration of Function by Tendon Transplantation in the Upper Limb. R. B. Zachary.

Brit. J. Phys. Med. **14**:277 (Dec.) 1951.

No muscle should be transplanted if it is weak for, in its new situation, its action will be less powerful than ever. If a recovering muscle is to be transplanted every effort should be made to strengthen its action before operation; for example, if there has been a lesion in continuity of the ulnar nerve at the same time as an irreparable radial nerve injury, it is useless to use the flexor carpi ulnaris as a transplant before it has recovered almost full strength. Vigorous exercises in flexion and ulnar deviation of the wrist, accompanied by faradism to the flexor carpi ulnaris may help to reduce the delay before operation. Moreover, it is probable that such exercises may enable the patient to control the action of this particular muscle, so that after transplantation re-education may be made easier. Perhaps the most important feature of the preoperative treatment is to ensure that there is free movement over the range of action which is to be regained. If joint stiffness has occurred, frequent and vigorous and long continued treatment by active and passive exercises and elastic traction is needed, and even capsulotomy may be necessary. The first and most important consideration of the postoperative treatment is to keep the limb in a satisfactory position during the time required for union of the transplant with the recipient tendon. The hand is put in a plaster cast for the first three weeks. After removal of this, an anterior plaster slab is then applied in the same position and reeducation is commenced. During the first week the plaster slab is removed for exercises starting first with the effect of gravity eliminated and then gradually adding the effect of gravity and increasing the duration of the exercises. Faradic stimulation of the transplanted muscle may help re-education. Tendon transplantation is a valuable method of improving the function of the limb, but the treatment must be planned with caution and carried out with care. There are few procedures which demand such understanding and close co-operation between patient, physical therapist and surgeon.

The Mechanism and Physiotherapeutic Relief of Pain. Clive Shields.

Lancet **6681**:459 (Sept. 15) 1951.

Pain is hard to define. The lexicographers and the poets are singularly unhelpful, for they invariably contrast pain with pleasure; but, since pleasure is an emotion, and pain is perceived through the senses, the two experiences are in no way comparable. Those who are concerned with the treatment of postural defects in children must have been impressed by the infrequency with which such patients complain of pain; whereas in the adult with these conditions it is generally pain that compels him to seek medical advice. It is noteworthy also that the localization of pain by children is very inexact. Precision in locating pain comes with the passage of years, and this can be due only to the storing of past experiences. Suggestion is used in the physical therapeutic relief of pain and is common to all therapeutic measures. For example, class exercises owe their superiority over individual exercises to suggestion, imitation, and competition, and few would deny the value of group therapy. The mechanism of rest in relieving pain depends on the cause of the pain, but generally it eliminates frictional irritation in joints, tendons, and muscles, and relieves muscle spasm; and in pain due to ischemia, whether of muscle or nerve, it reduces the metabolic requirements of damaged tissue. Conversely,

"rest pain," seen in peripheral circulatory failure, may be relieved by modified and graduated activity increasing the collateral circulation.

It is a common observation that pain due to swelling — e. g., in massive edema of the legs in cardiac failure or in nephritis — is always aggravated by coexistent inflammation. It has been suggested in explanation of this that in inflammation histamine or a histamine-like substance is liberated. The chief objection to this is that histamine when injected gives rise to itch but not to pain, and that histamine when ionized relieves certain types of peripheral pain. Further, Schumacher (1943) showed that a skin erythema induced by local irradiation with ultraviolet rays reduced the pain threshold of the treated skin by fifty per cent, whereas the same degree of erythema produced by nicotinic acid left it unaltered. He concluded that the difference was due to the presence or absence of inflammation. This is very confusing when we try to explain the mechanism of pain relief by counter-irritation. To say that counter-irritation operates because spatial summation does not take place with pain as it does with heat and cold, and that it is only possible to feel the greater of two simultaneous painful stimuli, is no doubt true, but it does not explain why moderate counter-irritation, not even reaching the intensity of discomfort, may abolish the primary pain. A prolapsed intervertebral disc gives rise to pain because it induces ischemic neuritis; and, though no physical therapy measure that the author knows of can reduce the prolapse, properly applied heat, combined with rest and traction, often can relieve pain by resolving the inflammation and surrounding edema which accompany the prolapse.

Spa Treatment — Its Relation to Medical Rehabilitation. R. A. Lockwood.

Brit. J. Phys. Med. **14**:255 (Nov.) 1951.

Although there is nothing new or mysterious about the beneficial effects of treatment at a spa, their use should not be forgotten or ignored by those giving physical treatments. The major British Spas are making a serious and useful contribution to general health and to those in need of rehabilitation in particular.

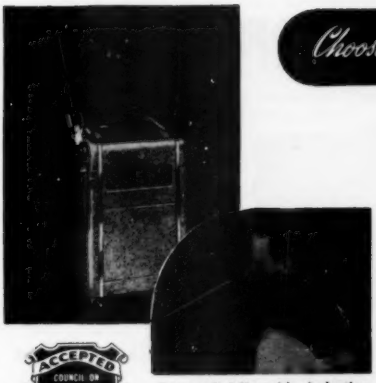
The aims of spa treatment generally may be summarized as follows: (1) Placing the patient in the most favorable environment for treatment and thus counteracting adverse psychological influence; (2) the removal of waste products due to faulty metabolism or infective process through the bowels, kidneys or skin; (3) the acceleration of the interchange between blood and tissue fluids by stimulating the circulation of blood and lymph; (4) improving metabolism so as to secure increased resistance to infection; (5) breaking down fibrous adhesions — dispersing thickenings in the muscles, tendons and joints, and (6) increasing, where possible, range of joint movement and re-education of muscle power and control.

These aims will be recognized as being eminently suitable for the treatment of the rheumatic group of diseases, but are equally applicable to other conditions such as poliomyelitis, postoperative and orthopedic conditions, and the after-effects of joint, bone and muscle trauma. A wide range of known physical treatments is used at all spas, and after diagnosis a treatment plan should be drawn up having regard to the physical, radiological and pathological findings, and the object in view. It is usual for a patient to be prescribed hydrotherapy and physical therapy treatments on alternate days, together with interspaced recreational, occupational and diversional therapy. It is the type of physical treatment classed as hydrotherapy which is not too well known to physicians and physical therapists, and which, in a large proportion of patients, is responsible for improvement. Quite often patients have received extensive massage, heat and electrotherapy, either as in-patients or out-patients at their local hospital before they are sent for treatment of the spa type. Some of the principal baths or forms of balneotherapy used are: immersion, aerated, douche massage, undercurrent douche, vapor, peat packs and baths, deep pool and therapeutic pool. Packing in towels, sheets and blankets forms an important part of the treatment. It is possible in a short article to deal with only a few of the many types of hydrotherapy used. The spa regimen, or as it must now be called — spa rehabilitation — utilizes all the forces that nature and man can provide. It is the combination of these factors which enables the physical therapist to achieve, objectively and subjectively, so much more than physical therapy alone.

Rehabilitation Unit. H. Worley Kendell.

Mod. Hosp. **78**:67 (Mar.) 1952.

Since the ideal of comprehensive medical care cannot be realized without physical medicine and rehabilitation, the extent to which these restorative techniques are offered as an essential part of the community health program is more or less a measure of the extent to which the ideal has been realized. The picture here is not entirely encouraging, and it now seems that the best hope for improvement lies with the general hospital. While the purpose of this paper is to discuss certain practical aspects of organizing and administering a department of physical medicine and rehabilitation in a general hospital, a prior consideration is a clear understanding of the function and scope of this relatively new specialty. The organization of a department of physical medicine and rehabilitation in a community hospital must begin with the community. Intelligent planning requires a thorough knowledge of local needs and resources, and utilization of them should stress integration. If planning is realistic as well as imaginative, many resources and much equipment not located in the hospital itself may be used in various stages of the rehabilitation process, with a net result fully as satisfactory as those achieved with vastly greater outlay in large cities. For example, tools and machinery of the local vocational school may be scheduled for use under a coopcrative plan; or certain exercising facilities in the high school may be utilized; or graduated work plans with the cooperation of industrial plants may be used.



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MEETINGS OF INTEREST TO THOSE IN THE FIELD OF PHYSICAL MEDICINE AND REHABILITATION

In this column will be published information about meetings of interest to those in the field of physical medicine. New data should be sent promptly to the office of the ARCHIVES, 30 North Michigan Avenue, Chicago 2, Illinois.

Chicago Society of Physical Medicine and Rehabilitation — regular monthly meetings, September through May, every fourth Wednesday. Milton G. Schmitt, Secretary, 6970 N. Clark St., Chicago 26.

New York Society of Physical Medicine — Monthly meetings held First Wednesday. Madge C. L. McGuinness, M.D., Secretary, 48 E. 62nd St., New York 21, N. Y.

Pennsylvania Academy of Physical Medicine and Rehabilitation — 1952, regular meetings on third Thursday of month. No meeting in December. 1953, regular meetings on third Thursday of month, held bi-monthly. Secretary, Charles A. Furey, M.D., 2201 St. James St., Philadelphia 3, Pa.

International

World Congress of the World Confederation for Physical Therapy — London, England, September 7-12, 1953. Secretary, Miss M. J. Neilson, Chartered Society of Physiotherapy, Tavistock House, South, Tavistock Square, London, W.C. 1, England.

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